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contents

VOLUME 48 MARCH 23, 1959 NUMBER 6

special articles

Identification of Unknown Synthetic Fibers. Part II—Applications of Polarized Light Microscopy 35
Sidney G Smith
An Improved Crockmeter for Yarn Testing ... 40
Stephen Korpanty and Charles R Trommer

aatcc proceedings

featured articles

Vat Dyeing of Cotton and Viscose Packages ... 43
Klaus J Bardt
The Practical Application and Control of Dieldrin for Durable Mothproofing 49
J P Redston

miscellaneous

AATCC Calendar 48
Future Papers to Appear in the Proceedings .. 57
Activities of the Local Sections 58
Membership Applications 59
Employment Register 59
Olney Medal Award Candidates 59
Organization of the AATCC 60

departments

General Calendar 39
Abstracts 41
Inter Alia-Inter Nos 61
P J Wood
News of the Trade 63
New Products and Developments 64
Technical Literature 67

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AMERICAN

DYESTUFF REPORTER

Volume 48 March 23, 1959 Number 6

IDENTIFICATION OF UNKNOWN SYNTHETIC FIBERS. PART II—APPLICATIONS OF POLARIZED LIGHT MICROSCOPY

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This paper is partly the result of a study of the polarized light microscopy of man-made synthetic fibers as applied to their identification.

It describes a working method, and it attempts to tie useful data into an analytical scheme previously published in the March 10, 1958 issue of *American Dyestuff Reporter* and referred to in the text as Part I.

Since the publication of Part I, some new fibers have appeared, and information about them relative to the method of analysis described is presented.

Also discussed is the possible effect of the new C-H-C process on the identification of Dacron.

A correction in Part I, Group 3 is given.

INTRODUCTION

THE main purpose of this paper is to add supplementary information to the analytical method presented earlier as Part I (*1*).

A large portion of the present paper is concerned with an investigation of the polarized light microscopy of synthetic textile fibers, and its application to the method reported in Part I.

Since the publication of Part I, several new fibers have appeared, and their optical properties will be discussed. They are Courtaulds' cross-linked cellulosics Corval and Topel, Du Pont's Dacron Type 64 and Eastman Chemical's polyester Kodel.

The possible effect on the identification of Dacron, of the new C-H-C finishing treatment (*5, 11*) is investigated.

A correction in Part I, Group 3 will be given.

The data presented are intended as a practical aid in the qualitative analysis of unknown synthetic fibers and their blends. Microscopical techniques are best suited to this, and the polarizing microscope is a powerful tool in the solution of these problems.

The theory of polarized light and its complex behavior is beyond the scope of this paper. Information and further references on this may be found in Chamot and Mason's "Handbook of Chemical Microscopy" (*4*). A previous paper by Heyn (*2*) contains much valuable data on the polarized light microscopy of textile fibers. Also, a review by West (*3*), which pertains to chemical identification rather then fibers, presents a wealth of information on working instructions.

DISCUSSION

The instrument used in the experimental work was a complete polarizing microscope. Among other things, it was equipped with a polarizing condenser, sliding-mount body tube analyzer, a slot above the objective to receive retardation plates, and keyed cross-hair eyepieces. Simpler equipment can be used as described in Part I, and in references *2* and *7*, although a rotating circular stage is practically a necessity. The light source was a ribbon filament lamp designed for critical illumination, with which neutral tint and blue daylight filters were used. The retardation plate was a first-order red with a violet sensitive tint. Magnifications from X200 to X400 were employed.

Most textile fibers are oriented aggregates of fine particles of doubly refractive material *(4)*, and as such show birefrigence. Birefringent materials resolve the vibrations of light that enter them and cause the light to vibrate in mutually perpendicular planes. This results in the fiber having two different refractive indices, one with the plane of vibration of the polarizer parallel to the length direction of the fiber, and the other with the polarizer vibration plane perpendicular to the length. Under crossed polarizers, a birefringent fiber will appear dark when its length direction is rotated parallel to the plane of vibration of the polarizer or analyzer (Figure 1). It is thus said to exhibit parallel extinction. All fibers do not exhibit parallel extinction, but most do, and all of the synthetics considered in Parts I and II have this property.

Under crossed polarizers, a birefringent fiber will appear bright (or show polarization colors) against a dark background when rotated to positions other than those of extinction. It is brightest in 45 degree positions in relation to the vibration planes of the crossed polarizers (Figure 1).

Upon rotation of 360 degrees, birefringent fibers will appear dark four times and bright four times; this, of course, if a very short length were observed, or a point on a long fiber covering the field.

Birefringence, or double refraction, is a property of anisotropic materials. It is the numerical difference between the refractive index of a fiber measured with the vibration plane of light from the polarizer parallel to its length, and the index measured perpendicular to its length. Depending upon whether the refractive index measured parallel to the fiber length (its optic axis) is greater or smaller than the perpendicular index, the fiber is respectfully optically positive or negative. An example of this could be nylon, whose parallel index is 1.58 and whose perpendicular index is 1.52. Nylon, therefore, is

optically positive with a birefringence of 0.06. The property of an anisotropic material to be optically positive or negative is known as the sign of birefringence, optic sign, and, in the case of elongated materials such as fibers, as the sign of elongation. For the sake of brevity, the term *optic sign* will be used in this paper.

Fibers that remain dark in all positions of rotation under crossed polarizers are not birefringent, and are called isotropic. They have only one index of refraction, and no optic sign.

A fiber that shows from dark to bright silver (or polarization colors if highly birefringent) in the 45 degree position under crossed polarizers (Figure 1), may be mounted in a medium of known intermediate refractive index. The direction of movement of the Becke Line on focusing up is noted, and the optic sign determined by whether the parallel index is higher than the perpendicular, or vice versa. This can be helpful in the case of highly oriented fibers whose polarization colors may not change much with a first-order red plate.

However, most of the synthetic fibers considered in this paper are only weakly birefringent, and their optic sign is easily determined by the use of a first-order red retardation plate. It is always well to check with this plate, because fibers that may be rather dark in the 45 degree position under crossed polarizers might be mistaken as isotropic without its use.

Information on retardation plates may be obtained from references *2*, *3*, *4*, and *6*.

As stated before, light passing through a birefringent material is separated into rays that vibrate both parallel and perpendicular to the material. One of the rays is slowed, or retarded behind the other. When the vibration of the fiber's slow ray is parallel to the fiber's length direction, its optic sign is positive. Under crossed polarizers and viewed in the bright position, this gives rise to polarization colors. These colors vary in hue and "order" according to Newton's series, the colored Michel-Levy chart of which may be found in reference *4*.

The first-order red plate, also called a selenite, gypsum, or half-wave plate, produces addition or subtraction colors in the fiber (higher or lower than the sensitive tint of the plate) depending upon whether the slow ray in the fiber and the slow ray in the plate vibrate parallel or perpendicular to each other.

As the direction of vibration of the

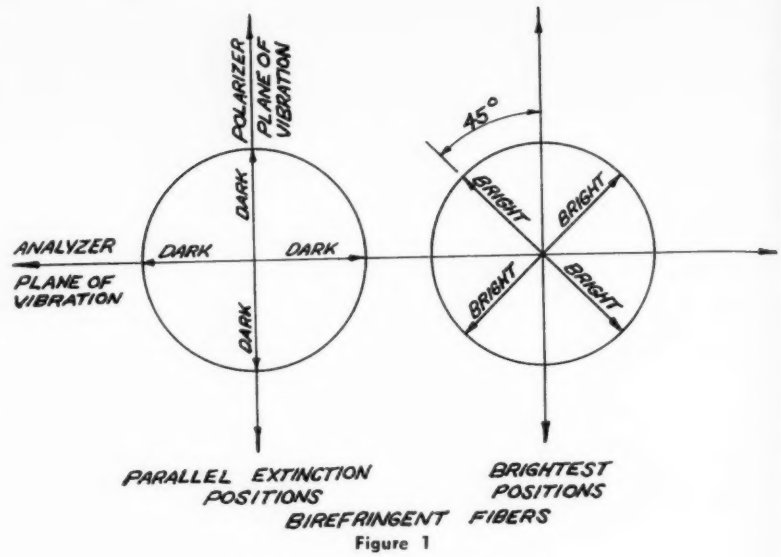

Figure 1

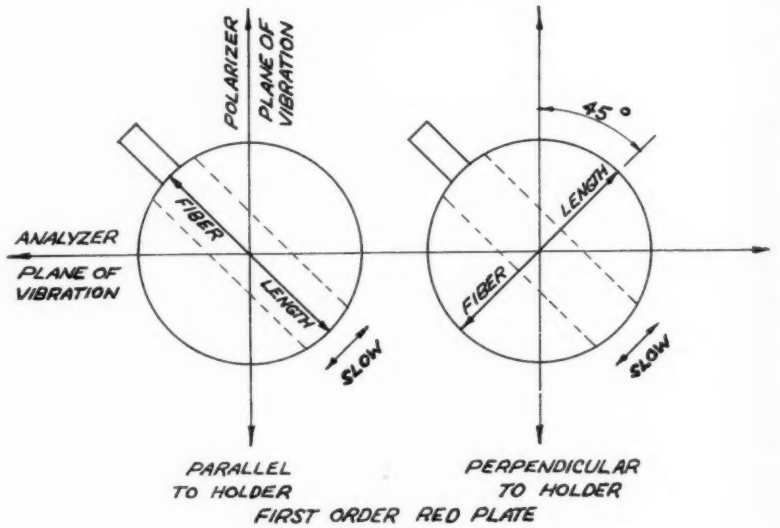

Figure 2

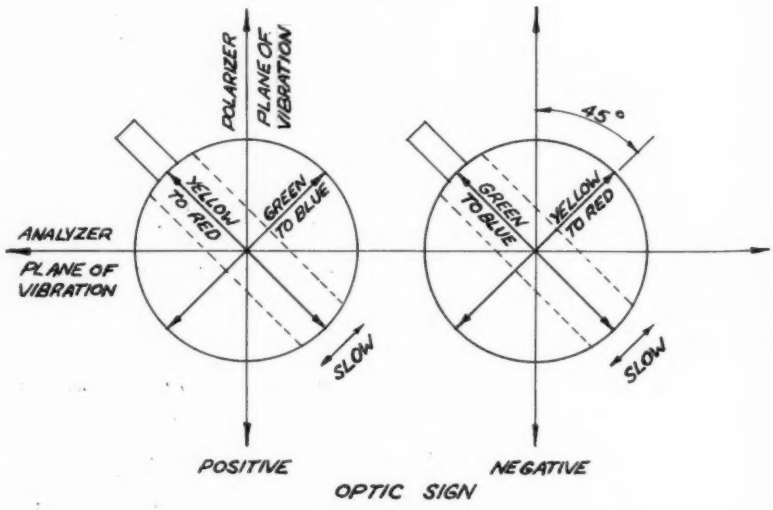

Figure 3

slow ray of the plate is known, one can tell the direction of the slow ray in the fiber and thus its optic sign.

Because most of the synthetics in this paper are weakly birefringent, they possess low order polarization colors and appear yellow (subtraction) or blue (addition) depending upon their optic sign and orientation to the slow ray of the first-order red plate.

However, as most retardation plates are mounted in a metal holder with the direction of vibration of the slow ray perpendicular to the length direction of the holder, it is convenient to refer parallel and perpendicular orientations of fiber length to the length direction of the holder (*2*). For the remainder of this paper, all references to parallel and perpendicular in conjunction with the use of the first-order red plate, are to the *length direction of its holder* (Figure 2).

The microscope body tube slot is placed so that the length direction of the plate holder is at 45 degrees to the vibration planes of the crossed polarizers (Figure 2).

With the polarizers crossed and the first-order red plate inserted, the field assumes the violet tint of the plate. When a weakly birefringent fiber is examined under these conditions, it will appear different colors when it is rotated through the four quadrants of the field (Figure 3). When the fiber is parallel to the vibration planes of the crossed polarizers (extinction positions), it will have the same color as the background tint of the plate. When its length direction is parallel to the length direction of the plate holder, it will be one color, and perpendicular another, depending on whether its optic sign is positive or negative. The sign of the fiber is *positive* if it appears yellow-to-red when parallel, and green-to-blue, when rotated perpendicular (Figure 3). The sign is *negative* if the fiber is green-to-blue when parallel, and yellow-to-red when perpendicular. If no color appears, and the fiber remains the same color as the background throughout rotation, it is *isotropic* and has no optic sign.

The determination of optic sign by means of a first-order red plate, can be applied directly to dyed synthetic fibers, without resorting to stripping of the dye. Even when the dye effects the colors produced by the plate, the change from a yellow-red to a green-blue on rotation of the fiber can be observed clearly enough to be diagnostic. The only exceptions are some very dark shades, and some blacks that render the fiber so opaque that no retardation colors can be observed.

A mica plate could also be used to determine optic sign, but dyes interfere and prevent its use. Similarly, the technique of estimating the numerical value of birefringence by reference to a chart of the polarization colors is not considered here, because absorption by the dye present can make difficult the recognition of "order" and affect the retardation colors (*4*). Therefore, in order to avoid stripping of dyes, we are concerned only with the determination of optic sign.

EXPERIMENTAL

POLARIZED LIGHT——The fiber is mounted in colorless mineral oil, n = 1.470. The upper element of the substage condenser is used, and if the condenser is provided with a swing-out upper element, this is swung into position. The analyzer is inserted and the polarizers are thus crossed, yielding a dark field. The stage is rotated until the length direction of the fiber is parallel to the vibration plane of the polarizers. This is parallel to either of the eyepiece cross hairs, and the eyepiece crosshairs must be parallel to the vibration planes of the polarizers. It is convenient to start in the 6-12 o'clock position. The fiber's extinction is noted.

Next, the fiber is rotated 45 degrees, its polarization color and degree of brightness is noted, and then it is rotated back to the 6-12 o'clock position.

A first-order red plate is inserted and the length direction of the plate holder will be at a 45 degree angle to the crosshairs (Figure 2). The fiber is next rotated *counterclockwise* 45 degrees, so that its length direction is parallel to the length direction of the plate holder, and its color noted (Figure 3). The fiber is now returned to the 6-12 o'clock extinction position, and then rotated 45 degrees *clockwise* so that its length direction is perpendicular, and its color again noted. Table I shows the properties of the synthetic fibers considered in this paper.

Grouping the fibers according to their optic sign we find:

Positive birefringence:

Acetate, alginate, Dacron 54 and 64, Dynel, Kodel, nylon, polyvinylchloride, Vicara, viscose (Corval, Topel).

Negative birefringence:

Acrilan, Creslan, Darvan, Orlon, Saran, Verel, Zefran.

No birefringence (isotropic):

Arnel.

NEW FIBERS —— Corval and Topel are crosslinked cellulosics. They are viscose-like in longitudinal and cross-sectional appearance. Their optical behavior under crossed polarizers and in the various mounting liquids in Part I is the same as viscose. As such, they would not be distinguishable from viscose rayon under this system of analysis. However, Corval is insoluble in cuprammonium hydroxide, whereas viscose is soluble (*10*).

Dacron Type 64 (*8*) is a polyester fiber that is said to possess improved pill resistance and affinity for selected cationic dyes as well as disperse colors. Type 64 has the same optical behavior as regular Dacron 54 in reference to the procedures in Part I. Type 64, like Type 54, shows a Becke Line that moves toward the fiber when mounted in 1-bromonaphthalene n = 1.657, and examined parallel. It would therefore be detected as Dacron in the method of Part I.

Kodel is a polyester fiber with a round cross section, high birefringence and polarization colors, and a general micro-appearance like Dacron and nylon. However, it is readily distinguished from these fibers by the method of Part I as discussed later in this paper.

EFFECT OF THE C-H-C PROCESS ON THE IDENTIFICATION OF DACRON——A new finishing process for improving certain fabric properties of Dacron has been recently described (*5, 9, 11*). This consists of Schreiner calendering, heat setting, and treating with caustic soda. If the caustic treatment removed the highly oriented skin of the Dacron, it might result in the inability of the fiber to be detected by means of the Becke Line method used in Part I. This, because the Becke Line movement is a function of the fiber's refractive index, and more specifically, of the index of the skin (*2, 4*). The high birefringence of Dacron is due to the highly oriented skin introduced during drawing, and if removed, its birefringence and high parallel index would be lowered.

A sample of Dacron tow was treated for 30 minutes at the boil in 3% caustic soda (on weight of bath), rinsed, neutralized with acetic acid, rinsed and dried. Another sample, a surrah fabric of 70-denier Dacron that had been treated by the C-H-C process, was provided by the Textile Fibers Dept of Du Pont upon request. Fibers from both samples behaved the same under test.

The fibers were mounted in 1-bromonapthalene, n = 1.657, and ex-

amined with light coming from the polarizer only. The direction of movement of the Becke Line upon focusing up was noted, first with the length direction of the fiber parallel, and secondly perpendicular to the vibration plane of the polarizer. Parallel, the line moved toward the fiber, and perpendicular, toward the liquid. This is same behavior as untreated Dacron, and the C-H-C process does not interfere with the identification of Dacron by the Becke Line method.

It appears that the caustic soda treatment may remove some of the plastic-like fabric surface and stiffness produced during Schreiner calendering (*5, 11*), but enough of the highly oriented skin remains that the optical properties considered here are not altered.

APPLICATIONS OF THE DATA TO THE ANALYTICAL SCHEME IN PART I

Before dealing with the application of new data, a correction in Part I, Group 3 will be given. In mineral oil, n = 1.470, acetate, Arnel, and Darvan are only faintly visible. Their Becke Lines are indistinct, and actually move toward the fiber instead of toward the liquid as stated. Therefore, under the heading "Group Separation," the section under the subheading "Group 3" should read as follows:

"GROUP 3———Mount in colorless mineral oil, n = 1.470, and examine perpendicular. Fiber is only faintly visible: acetate, Arnel, Darvan.

"Mount in toluene, n = 1.496, and examine parallel or perpendicular. Becke Line moves toward liquid: acetate, Arnel, Darvan.

"In mineral oil, all other fibers in all groups are visible, and in toluene they all have Becke Lines that move toward the fiber both parallel and perpendicular."

In the application of new data, technique and methods are according to those given in Part I as in Part II.

At the beginning of group separation, the unknown is mounted in colorless mineral oil, and after the fiber structure and visibility are noted, the instructions given in this paper under the heading Polarized Light are applied. This includes the use of the first-order red plate.

GROUPS 1 AND 2———Dacron, nylon, Kodel, viscose.

Kodel falls in Group 1 because of its high birefringence and colors under crossed polarizers. Examination in 1-bromonaphthalene and then in monochlorobenzene is necessary to distinguish between Dacron, Kodel, and nylon.

In 1-bromonaphthalene, n = 1.657, and examined parallel, Kodel shows a Becke Line on focusing up that moves toward the liquid, whereas Dacron's Becke Line moves toward the fiber. Nylon's line also moves toward the liquid. In monochlorobenzene, n = 1.522, and examined perpendicular, Kodel's line moves toward the fiber, whereas nylon's line moves toward the liquid. Dacron's line would also move toward the fiber, but it has been detected or eliminated by first mounting in 1-bromonaphthalene.

All of the fibers in Groups 1 and 2 have a positive optic sign.

GROUP 3———Acetate, Arnel, Darvan.

Acetate is dull silver at 45 degrees under crossed polarizers, and clearly positive with the first-order red plate.

Arnel remains dark in all positions under crossed polarizers, and shows no color change on rotation with the first-order red plate. It is therefore isotropic, with no optic sign, and is the only fiber among all considered in Parts I and II with this behavior. With the first-order red plate, occasionally an extremely faint color along parts of the fiber may be seen, but for all practical purposes the fiber is isotropic. This affords a simple method of distinguishing between acetate and Arnel.

Darvan is dull silver at 45 degrees under crossed polarizers and is negative with the first-order red plate, which distinguishes it from the other two members of this group.

GROUP 4a———Acrilan, Creslan, Orlon, Zefran.

All of these fibers are silver at 45 degrees under crossed polarizers and all are negative with the first-order red plate.

GROUP 4c———polyvinylchloride (Rhovyl).

Polyvinylchloride fiber is dull silver at 45 degrees under crossed polarizers, and is positive with the first-order red plate. It can thus be readily distinguished from the acrylics with round cross sections,

TABLE I

Fibers mounted in mineral oil, n = 1.470, crossed polarizers. Fiber length direction related to length direction of plate holder.

		First-order red		
	45 Degrees	*Parallel*	*Perpendicular*	*Optic sign*
Acetate, bright, nat, various den	dull silver	orange-red	green-blue	positive
" dull, nat, various den	" "	" "	" "	"
Acrilan, semidull, nat	bright silver	green-blue	orange-yellow	negative
" " royal blue	" "	" "	brown-yellow	"
" " brown	dull silver	dull green-blue	dull brown-red	"
" " dk brown	" "	dull blue	dull red	"
" bright, med red	red silver	blue	orange-red	"
Alginate, nat	dull silver	lt red	green-blue	positive
Arnel, bright, nat	extinction	no color	no color	isotropic
" dull, nat	"	" "	" "	"
" " med red	"	" "	" "	"
" " med brown	"	" "	" "	"
" " royal blue	"	" "	" "	"
" " bright red	"	" "	" "	"
" " navy blue	"	" "	" "	"
Corval, bright, nat	colors	colors	colors	positive
Creslan, semidull, nat	bright silver	green-yellow edges green	yellow edges orange	negative
" " dark red	dull red-silver	blue center edges red	all red	"
" bright, royal blue	bright silver	green-blue	lemon-yellow	"
Dacron	bright colors	bright colors	bright colors	positive
Darvan, bright, nat	dull silver	green-blue	orange-yellow	negative
Dynel, nat	dull silver edges, dark center	edges orange-red center none	edges blue-green, center none	positive
" dk brown colorspun	edges lighter	edges orange-red	edges dull green	"
" black colorspun	interference	interference	interference	———
Kodel, semidull, nat	colors	colors	colors	positive
Nylon, " "	"	"	"	"
" " black	"	"	"	"
Orion, " nat	silver	green-blue	orange	negative
" " dk green	dull silver	blue	red-brown	"
" " dk brown	" "	dull-green-blue	dull red-brown	"
" " med brown	" "	green-blue	orange-brown	"
" " med red	" "	" "	orange	"
" " full red	" "	blue	orange-red	"
" " royal blue	silver	"	orange-brown	"
" " turquoise	"	"	" "	"
Polyvinylchloride (Rhovyl) nat	dull silver	orange-red	green-blue	positive
Saran 10 d/f, nat	whitish-lemon-yellow	bright yellow edges green	yellow-white	negative
" 22 d/f, full green	yellow edges white	center purple edges yellow-green	grey-white	"
Topel, bright, nat	colors	colors	colors	positive
Verel, dull, nat	silver	blue	orange-red	negative
Vicara, semidull, nat	"	red-yellow	green-blue	positive
Viscose, bright, nat	colors	colors	colors	"
Zefran, semidull, nat	bright silver	green-blue	yellow-orange	negative

such as Acrilan, Creslan, and Zefran in Group 4a, because these all have a negative sign. It is the only fiber in all of Group 4 that has the following: a round cross section, no polarization colors (except dull silver), and a positive sign.

GROUP 5a———alginate, Dynel, Verel, Vicara.

Calcium alginate is rarely met with, and is positive with the first-order red plate. It has a characteristic cross section.

Dynel is dull silver (sometimes the edges are dull silver and the center dark) at 45 degrees under crossed polarizers and is positive with the first-order red plate. This positive sign makes it easy to distinguish in blends from the other acrylics with which it is frequently met.

Verel is negative and is the only negative fiber in Group 5a. It has a dog-bone cross section which identifies it in this group.

Vicara is positive and it is the only fiber in Group 5a with a round cross section.

GROUP 5b———

Saran has a negative sign. It is the only fiber among all considered in this paper that is round, and is a whitish-lemon-yellow in the 45 degree position under crossed polarizers (no first-order red plate). The rest of the fibers either show polarization colors or are bright to dull silver in this position. Some fibers, such as viscose, may be lemon-yellow at places away from twists, but they show other colors at the twists and they are not round.

SUMMARY

The use of some of the techniques of polarized light microscopy provides much useful data in the identification and confirmation of unknown synthetic fibers. They have the advantages of ease of application and speed.

The first-order red plate can quickly point out the presence of different fibers in a blend when they are mixtures of optically positive and negative. One example of this was a supposedly all-Orlon yarn, which contained enough polyvinylchloride fiber as a contaminant to have caused faulty piece dyeing later on.

The procedures discussed should be easy enough to carry out by the textile chemist who may not have much experience in the use of the polarizing microscope. However, it would be well to consult some of the literature cited in order to gain more information on this subject.

Some of these fibers are in pilot-plant or semiworks production and must be watched for possible change in properties when they are commercially produced. Recent samples of Creslan have shown a mixed round and dog-bone cross section, instead of all-round as it was earlier.

It is hoped that the additional data presented here may be helpful in the identification of man-made fibers.

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General Calendar

AMERICAN ASSOCIATION FOR TEXTILE TECHNOLOGY
Apr 1 (Della Robbia Room, Hotel Vanderbilt, New York, NY)

AMERICAN COTTON MANUFACTURERS INSTITUTE
April 15-16 (ACMI Cotton Fiber Testing Lab Open House, The Clemson House, Clemson, SC

AMERICAN OIL CHEMISTS SOCIETY
April 20-22, 1959 (Roosevelt Hotel, New Orleans, La; Sept 28-30, 1959 (Statler Hotel, Los Angeles, Calif)

AMERICAN TEXTILE MACHINERY ASSOCIATION
May 23-27, 1960 (American Textile Machinery Exhibition, Auditorium, Atlantic City, NJ)

CANADIAN ASSOCIATION OF TEXTILE COLOURISTS AND CHEMISTS (QUEBEC SECTION)
Apr 18 (McGill Univ, Montreal, Que); June 20 (Annual Golf Tournament)

DRUG, CHEMICAL AND ALLIED TRADES SECTION, NY BOARD OF TRADE
Sept 17-20 (69th Annual Meeting, Sagamore Hotel, Bolton Landing, Lake George, NY

GORDON RESEARCH CONFERENCE ON TEXTILES
July 13-17 (Colby Jr College, New London, NH)

INTER-SOCIETY COLOR COUNCIL
April 1 (28th Annual Meeting, Statler Hilton Hotel, New York, NY)

THE FIBER SOCIETY
April 29-30 (Fontana Village, NC)

KNITTING ARTS EXHIBITION
May 4-8 (Atlantic City Auditorium, Atlantic City, NJ)

NATIONAL COTTON COUNCIL
May 12-14 (1959 Cotton Research Clinic, Grove Park Inn, Asheville, NC)
Oct 7 (Chemical Finishing Conference, Mayflower Hotel, Washington, DC)

PHI PSI FRATERNITY
April 23-25 (56th Annual Convention—Atlanta Biltmore Hotel, Atlanta, Ga)

PURDUE INDUSTRIAL WASTE CONFERENCE
May 5-7 (Purdue Memorial Union Bldg, Purdue Univ, Lafayette, Ind)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
April 14, June 9, Sept 15, Oct 13, Nov 4 (Luncheon meetings at the Hotel Roosevelt, New York, NY); May 11-13 (Spring Outing—The Cavalier, Virginia Beach, Va); Dec 2 (Annual meeting and dinner—Hotel Roosevelt, New York, NY)

TEXTILE SUBCOMMITTEE, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
April 2-3 (1959 Conference on "Electrical Applications in the Textile Industry," Heart of Atlanta Motel, Atlanta, Ga)

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AN IMPROVED CROCKMETER FOR YARN TESTING

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AN earlier paper (*1*) describes a modified Crockmeter for yarn testing, which has been in use for the past three years. The basic principle involved has proven to be very practical, but the method of mounting the white test square is cumbersome and not always reliable. The rubber bands used occasionally slip off and also cause the test square to wrinkle.

This paper describes an improved method of mounting the test square to overcome the problems inherent in the use of the rubber bands.

A device to hold the test patch in place on the modified Crockmeter may be improvised as follows:

1) Assemble the following materials:

One #1 Hunt clip (small spring-loaded paper clip).
One 3/16-inch bolt 1⅛ inches long with a washer.
One four- to six-inch length of brass rod.
One spring, compression-type, requiring eight to 24 ounces to depress, inside diameter 3/16 to ¼ inch.
One three-inch-length phosphor bronze or stainless-steel wire approximately 0.032 inch in diameter.
One knob (small radio control knob with set screw).
Optional: One bushing, bronze or brass 3/16-inch bore, ½-inch outside diameter, one inch long.

2) Bend the finger grips of the #1 Hunt Clip as shown in Figure 1. Position it so that the spring section just touches the horizontal dowel and is centered on the dowel. Mark and drill a 3/16-inch hole in weighted head at this point.

3) Bolt the prepared clip into place using the washer between the clip and the nut.

4) Drill a 3/16-inch hole, centered and forward of the horizontal dowel. This is best done by turning the Crockmeter upside down so the horizontal dowel points up. Locate the center and drill with the drill just clear of the horizontal dowel. A drill press will insure a perpendicular hole. If no drill press is available, care should be taken to hold the hand drill in a direct line and square with the surface. Try the 3/16-inch brass rod for fit. It should slide through with little or no drag. If necessary, open the hole with a small round file until the rod passes through easily. If the Crockmeter is to be in frequent use, it is advisable to incorporate a brass or bronze bushing at this point. To do this, enlarge the hole from the top of the Crockmeter bar to the size of the bushing selected. Here again, the rod should pass through freely.

5) Slot the end of the rod with a hacksaw to a depth equal to twice the diameter of the wire that will become the hooks. Place the midpoint of the wire in the slot and hammer the slot closed to secure the wire in a tight joint. Bend the wire to form an inverted "V". At a point approximately one-half inch from the end of the rod, a spread of one-half to ¾ inch should result. About one-half inch from the rod, bend both ends forward and upward. Clip the wire leaving about ⅛ inch. Sharpen these ends to pin points. Next bend both prongs toward the rear until they lightly brush the horizontal dowel when the rod is moved up and down.

6) Place the compression spring over the upper portion of the rod. At this point, a little experimentation will be required to find the point at which to cut off the rod. Be careful to allow room for the knob. The coiled-spring tension should equal the holding abilities of the spring clip to insure that the white cloth test square will remain firmly in place when in use. Secure the knob in place.

7) Reassemble the Crockmeter.

8) In operation, the patch is held between the forefinger and middle finger of the right hand with palm up. Open the spring clip with the left hand. Insert the patch and release the clip. Depress the rod with the left thumb and brush the patch against the horizontal dowel onto the hooks with the right middle finger. Release the rod. To remove the patch, open the clip and take the patch off the hooks.

Extensive use of the modified instrument has brought out two points of particular interest:

1) It is advisable to have the yarns stretched fairly taut, completely parallel to each other, and only *one layer thick*. Very thick yarn bundles provide excessive padding with a resultant cushioning effect which can lead to a false test result. When one considers that most fabrics are the thickness of only two yarns at a maximum, the reason for this point becomes obvious.

2) The question has come up that the width of yarn sample should be extremely critical since the constant head weight applied over varying sample areas will produce varying pressures per unit area. While theoretically sound, actual tests on samples ⅛-inch wide and 1½-inches wide produced identical levels of color transfer. The conventional finger does exert a constant pressure per unit area but suffers from the problem cited in the earlier paper (*1*). For routine use, samples of approximately ¾-inch wide ±¼ inch have proven most useful.

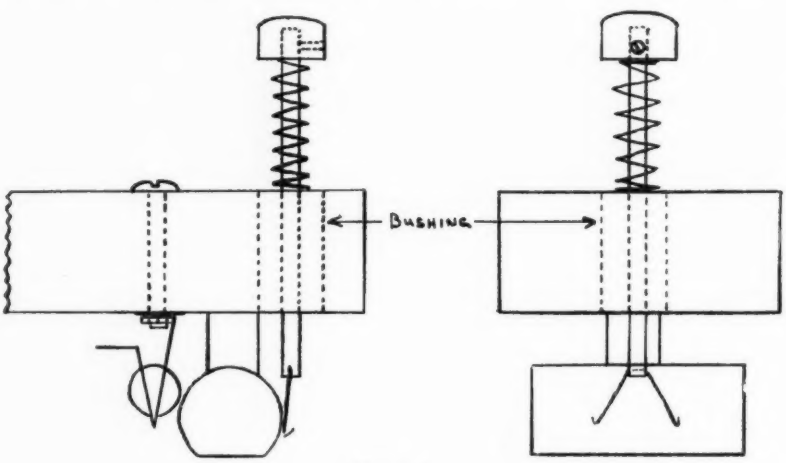

Figure 1

LITERATURE CITED

(*1*) Trommer, C R, "Modification of the AATCC Crockmeter for Yarn Testing", *Am Dyestuff Reptr* 45, No. 12, 357-9 (1956).

Abstracts

Felisol—An International Information Label for Colorfastness

McLaren, K, *Dyer* 121, 111-12, Jan 16, 1959.

In 1952, the four German dye firms into which the IG had been split by the Allies formed the "Indanthren Trade Mark Association" to continue the publicity which had been so effective. Dyers and printers in other European countries realized the advantages of the Indanthren label, but naturally did not want to have their dyestuff purchases restricted to only one country (Germany), and they asked the Association Internationale de la Teinturie Textile to consider the creation of an international label which would give a similar guarantee but would not restrict the dyer or printer with regard to supplies.

In consequence, the "International Association for the Felisol Fastness Label" was organized in 1956, with headquarters at Zurich, Switzerland. The name "FELISOL" was derived from the original French name "Federation du Label Internationale de Solidite."

The author describes the new organization as follows:

"The Felisol Association is open to dyestuff manufacturers who produce and sell dyes which conform to the specifications laid down by the Association and to one specially created national organization of dyers and printers in each country.

"The label is initially restricted to natural and regenerated cellulosic fibers, as it is only for cellulose that there are a sufficient number of dyestuffs of high all-round fastness which will enable most shades to be obtained, and which are made by most of the dyestuffs manufacturers selling in Western Europe.

"While the backbone of any guarantee for cellulosic fibers must be vat dyestuffs, it is not much use merely making the consumer 'vat dye conscious', which is the aim of the Vat Dye Institute in the USA. The reasons for this are as follows:

"1) Not all vat dyes are fast enough; the Indigoid vat dyestuffs contain many of relatively poor fastness properties.

"2) Not all anthraquinone vat dyestuffs are suitable for all purposes.

"3) Many vat dyestuffs have poor lightfastness in pale shades.

"4) Some vat dyes accelerate photo-tendering, and therefore should not be used for curtains.

"5) A reasonable range of red shades cannot be obtained."

Cellulosic textiles have been divided into three groups, according to end-use. Minimum fastness requirements (to light, washing and weathering) have been set up, and the individual dyes of the interested manufacturers have been classified according to their suitability. "ECE" test methods (of the Europaeisch-Continentale Echtheits Convention) are used, and in the case of lightfastness, exposure to daylight only is specified.

In one or two cases, dyestuffs which do not meet the final minimum requirements have had to be included to provide a full range of shades for the user.

If in any country six or more dyers or printers are willing to join Felisol, a national organization is formed. At present, Holland, Italy, Switzerland, Austria, Belgium and Spain have such organizations.

Amine Odor in Resin-treated Fabrics

Nuessle, A C, Heiges, E O J and Olney, R A, *Dyer* 120, 785-6, Nov. 21, 1958.

One of the problems in the use of nitrogenous resins on textile fabrics is the spasmodic and usually unpredictable development of fishy amine odors. The incidence is not high, considering the millions of yards of fabrics that are resin-treated, but the odor is so unpleasant that when it occurs it almost always leads to a complaint.

An investigation was made in 1953 to determine the factors influencing the development of this odor in urea-formaldehyde (UF) finishes. Later it was extended to include ethylene-UF finishes and the so-called triazones.

A test for amines, used in this study, involves boiling the fabric sample in water under controlled conditions and distilling the amine over into an iodine solution. A dark brown precipitate shows the presence of a tertiary amine; in most cases this is trimethylamine.

By using special laboratory techniques it was found, in the case of UF resin, that three ingredients are necessary to produce odor: ammonia, formaldehyde and formic acid (or a formic salt). If any one of these is completely eliminated, no fishy trimethylamine will be produced. Unfortunately, ammonia and formaldehyde cannot be completely excluded, as sufficient quantities can be produced during the cure by breakdown of the urea resin. Therefore the formate component is the only one which is subject to control.

Methods of eliminating or reducing formate content in the resin bath include 1) deionization shortly before use, 2) use of freshly made resin, 3) avoidance of other finishing agents containing formic acid as an ingredient (eg, certain water repellents).

In the case of ethylene-UF resins, since these are more stable to heat than UF, no ammonia is produced during a normal cure, and if all other sources of ammonia are avoided, no odor (trimethylamine) will be produced, regardless of the presence of formaldehyde and formate. It was also found that absence of formate (in the ethylene-UF resins) does not necessarily prevent amine formation if ammonia and formaldehyde are both present.

It is pointed out that, by the use of a zinc nitrate catalyst with these resins, not only may the use of an ammonium salt catalyst be avoided but also—should a source of ammonia be present through error—the zinc salt will tend to hold the resulting trimethylamine so that it will not be liberated until the fabric is given its first alkaline washing.

According to the author, most types of triazones produce a certain amount of fishy odor despite attempts to control the formate and ammonia content.

Bleaching of Wool and Mixtures with Hydrogen Peroxide

Woodford, G C, *Dyer* 120, 867, Dec 5, 1958.

Bleaching of wool under acidified hydrogen peroxide conditions has a number of advantages, according to the author. These include a lower degree of chemical modification and improved hand of the wool, which is in better condition for subsequent acid dyeing. Most acid milling dyes are fast to the bleaching process, and cloths with colored effects of this type can be treated.

The author describes the bleaching of blankets and woolen rugs by the acid peroxide method. If formic acid is used, there is danger that the employment of an odorless bleach instead of sulfur stoving may lead to an increase in the liability to moth attack. He suggests instead the use of Stabilizer MP, which is based on acid fluorides and gives the correct acid conditions in the peroxide bath without danger of colors bleeding

from headings dyed with acid milling dyes. The wool so bleached is also resistant to moth attack up to the first wash.

The moist blankets are passed through the bleaching solution at 60-100° F, at a pH of 3.5-5.5, are squeezed, and are preferably aged over night before drying, to obtain complete penetration. Bleaching takes place during and after drying. Exposure of the cloth to strong sunlight during the process should be avoided.

Other subjects discussed by the author are bleaching worsted sliver in the back wash unit using hydrogen peroxide, continuous bleaching of woolen and worsted yarns, also with peroxide, and the bleaching of pigmented wool by the hydrogen peroxide/ferrous mordant process.

Excessive Drying and Fiber Damage

Grant, J N and Merkel, C M, *Textile Bull* **84**, 48-51, Nov, 1958.

The poor spinnability of certain American cottons has been attributed to the excessive drying of seed cotton at the gins. Research investigations at the Southern Regional Research Lab in co-operation with the U S Ginning Research Lab, Stoneville, Miss, have been directed toward finding what changes were produced by excessive drying that might cause spinning troubles (eg, a decrease in mean fiber length and an increase in the quantity of short fibers).

Other conditions which could increase the quantity of short fibers are bacterial damage, drouthy field conditions, and improper machine settings. However, the complaints from the textile mills usually blamed over-drying at the gins.

Studies of undried, moderately dried and excessively gin-dried cottons (365°F) of average characteristics have shown that excessive drying prior to ginning and cleaning can decrease mean fiber length as much as 5 percent, and at the same time can increase the quantity of fibers less than ½" long by 8 to 10 percent. Also it is reported that the classer's staple length may be decreased as much as 1/16-inch by certain conditions of drying and ginning. Moderately dried cotton, which has 5 to 7% moisture, has been ginned without appreciable damage to the properties of the cotton.

Yarns spun from cotton whose fiber lengths were decreased by breakage produced by excessive drying before ginning and cleaning were weaker, less uniform and less resistant to flex-abrasion than yarns spun from a portion of the same lot of cotton not dried before ginning and which had a normal fiber length distribution.

The reasonable explanation for more breakage in excessively dried than in undried cottons is found in the differences in strength and elongation between the moist and dry cotton fibers. In recent studies the strength of single cotton fibers heated at 320°F for 15 seconds and tested before the fiber had cooled was 20% less than that of the unheated fibers, whereas the strength of fibers which were heated but allowed to recover their moisture before testing was not reduced.

Epoxy Resin Blended Finishes for White Cottons

Gagliardi, D D and Shippee, F B, *Textile Research J* **29**, 54-65, Jan, 1959.

New and improved effects have been produced on white cotton fabrics by means of blends of epoxy resins with selected aldehydes, acetals, formaldehyde-amino resins, hemiacetals, and polymeric materials such as silicones, polyethylene, polyacrylates and epoxy-based plasticizers. With some of the formulated blends, durable wash-and-wear finishes, crease resistance and dimensional stability are obtained.

The most outstanding properties of the epoxy resins for use in cotton finishing, according to the authors, include the following:

1) Complete durability of the finish to laundering.

2) Complete resistance to damage by chlorine bleaches.

3) Complete absence of amine or formaldehyde odors.

The first two properties result directly from the chemical reaction of epoxy groups with cellulose to give nonhydrolyzable bonds, and from the nonnitrogenous nature of the compounds which prevents chloramine formation in bleaching. The third property results from the absence of any residue in the epoxy structure which could give odoriferous byproducts in curing or in practical use of the treated fabric.

An outstanding finish for white cottons has been developed based on combinations of epoxy resins with dimethylol ethyleneurea. The authors state that this finish has been used commercially for two years in producing wash-and-wear white cotton fabrics. Tables are given showing the effect of the treatments on tensile strength, crease recovery, chlorine damage, etc.

The practical conditions of cloth preparation, drying and curing cycles, choice of catalysts, washing procedures, and afterfinishing operations are described for obtaining optimum results. The best results were obtained with zinc fluoborate as catalyst.

A drawback to the use of epoxy resins is said to be their relatively high cost compared with existing cotton finishing resins (eg, dimethylol ethyleneurea) and the higher concentration of epoxy solids required to give high-level crease resistance and wash-and-wear performance. Work is being continued, looking for more economical epoxy systems.

Ten references to the literature are cited.

Versatile Latex Compounds from Synthetic Rubber: Properties and Applications of Nitrile Rubber Latices

Anon, *Man-made Textiles* **35**, 64, 66, Dec, 1958.

The series of nitrile rubber latices known as "Hycar" are water dispersions of acrylonitrile-butadiene copolymers. They are employed industrially in many ways.

In the textile industry they are used in many different processes: warp sizing, fabric impregnation and coating, printing, and in fabric finishing to improve both the physical properties and the appearance of the finished product. Excellent abrasion resistance, crease and crunch resistance, high tear and tensile strength and improved soft and full hand and drape are among the properties obtained by their use.

The latices are used most effectively on rayon and cotton fabrics and rayon/cotton blends. They are also used to provide nonskid backings for rugs and carpets.

Hycar 1561 (high acrylonitrile content) is used for the sizing of certain classes of warps in fabrics that receive a loomstate finish. It is not removed by repeated laundering.

In dyeing synthetic fibers and blends of synthetics and wool with vat dyes, the addition of small amounts of Hycar latex to the padding liquor is said to increase the amount of dye fixed on the fibers, resulting in increased uniformity and retention of color. Development work on this method was carried out by Clemson College, USA. (See *ADR* 43, 48-9, 1954.)

Addition of Hycar latex to amino resins (eg, urea-formaldehyde) used for shrinkage control is said to improve the tear strength and abrasion resistance of the fabric.

Hycar latices may also be used as the binding media for nonwoven fabrics. Details of this application are given. The fabrics are said to possess good washability, resistance to drycleaning solvents, good crease recovery, good tear strength, and good resistance to discoloration.

Proceedings of the

American Association of Textile Chemists and Colorists

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March 23, 1959

Niagara Frontier Section———

VAT DYEING OF COTTON AND VISCOSE PACKAGES*

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This paper discusses some practical aspects of package dyeing. The package type, flow pattern, rate of flow, temperature, leveling agents and some modified dyeing methods are discussed.

A selection of commonly used vat dyestuffs is briefly summarized.

INTRODUCTION

PACKAGE dyeing is an art, and like any art, it permits a multitude of approaches towards the same goal and therefore cannot be limited by a fixed set of rules. The following discussion does not attempt to cover every aspect. It is a brief review of some practical approaches taken in everyday plant production.

DISCUSSION

FLOW PATTERN———The most critical factor in package dyeing, regardless of the dyestuff class involved, is the "rate of strike." This factor is of even greater importance when dyeing with vat dyes, since these products lead all other dyestuffs in their rapidity of strike and slowness of diffusion. Successful vat dyeing of packages is therefore always the result of controlling the liquor flow and rate of strike in such a manner that the former compensates for the latter. *Example:* CI Vat Blue 20 applied on cotton exhausts 80% in three minutes and reaches maximum exhaustion in nine minutes. (Figure 1).

If the total dyebath is circulated, however, let's say nine times through the yarn during these three minutes, the rapidity of strike is compensated for to a large degree by assuring an even distribution due to a fast rate of flow. In a liquor ratio of 10:1 this means that three gallons of liquor must pass through a one-lb package every minute. Besides the efficiency of the pump, the type of package used determines the success of the dyeing operation to a large extent. Comparing the proportions of the measurements of conventional package types, one easily realizes the advantages of using one type against the disadvantages offered by another type.

Example: A 20-oz package wound on a 5/8 tube has an outside area of 116 square inches or 100%. The inside surface is 11.7 square inches or 10.2% of the outside area, while the area of the openings in the dye tube is 0.9 square inch or 0.8% of the total outside area. The distance from the tube to the outside surface is 1.94 inches. Compared with this package, a compressed Franklin spring package has an outside area of 78.4 square inches. This is considerably less than the aforementioned package because the Franklin system has the exposed ends of the packages sitting on top of each other. The inside surface of this package is 26.5 square inches, or 34% of the outside area, while the openings which allow dye to pass into the package from inside are 13 square inches or 16.7% of the outside area. The 1⅝-inch tube shows similar proportions to the Franklin spring; however, since its ends are exposed to the dye liquor, the proportions are somewhat less balanced. (Figures 2 and 3).

From a comparison of these figures, it can be concluded that the pump capacity, the direction of flow, or even the flow pattern and the density of the package is much more critical when dyeing a package with a 5/8-inch tube than when working

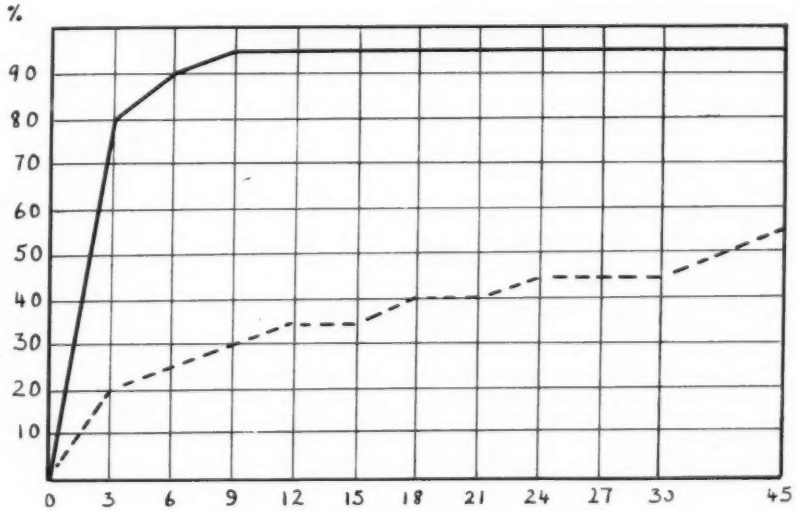

Figure 1
Exhaustion curve of CI Vat Blue 20

——— without retarding agent ——— with retarding agent

*Presented at a meeting of the Niagara Frontier Section held at the Park Hotel, Niagara Falls, Ontario, September 26, 1958.

with a 1⅝-inch tube or Franklin spring.

The rate of strike itself can be controlled to compensate for shortcomings of the machinery, the packages or the dyestuffs. The following approaches may be considered:

a) Leveling agents.
b) Temperature control.
c) Application of the dye in an easily controllable unreduced form.
d) Application of modified leuco forms.

LEVELING AGENTS —— The rate of strike of vat leucos can be reduced by using substances which have an affinity for the dyestuff and form with it either salt-like structures or loose agglomerates. These in turn have no affinity for the fiber. However, on contact, and under the influence of temperature and time, they break down into their original compounds, thus releasing the dyestuff gradually. Proteins, such as glue, gelatine, lignin sulfates and polyethers, perform this function to varying degrees. Benzimidazole sulfonate derivatives, such as Albatex PO, have this effect to a very marked degree. Thus the rate of absorption is slowed down. (Figure 1).

The dye/benzimidazole sulfonate derivative complex is not stable enough to prevent completely the absorption of the dyestuff by the fiber. Rather, the process is characterized by a *slow* migration of the dyestuff from the benzimidazole sulfonate derivative to the fiber. By adding substances to the dyebath which have a higher affinity for the benzimidazole sulfonate derivative than the dyestuff, eg, Invadine BL Conc, the dyestuff is *quickly* liberated and migrates to the fiber. The use of leveling agents is general practice in most mills using vat dyestuffs and this assures satisfactory results in the majority of cases. However, when circulation is poor, the material is either viscose, hard-twisted cotton or mercerized cotton, or if the dyestuffs used are little affected by the leveling agent in question, additional safeguards must be employed to assure good dyeings.

TEMPERATURE CONTROL—— —Temperature has a great effect on the rate of diffusion of the vat leuco into the fiber. In addition, it influences the solubility of the leuco and the rate of strike. The rate of strike is more affected where viscose rayon is concerned than with cotton. (Figures 4, 5 and 6).

The solid lines in Figures 4b and 5b show the function of temperature/

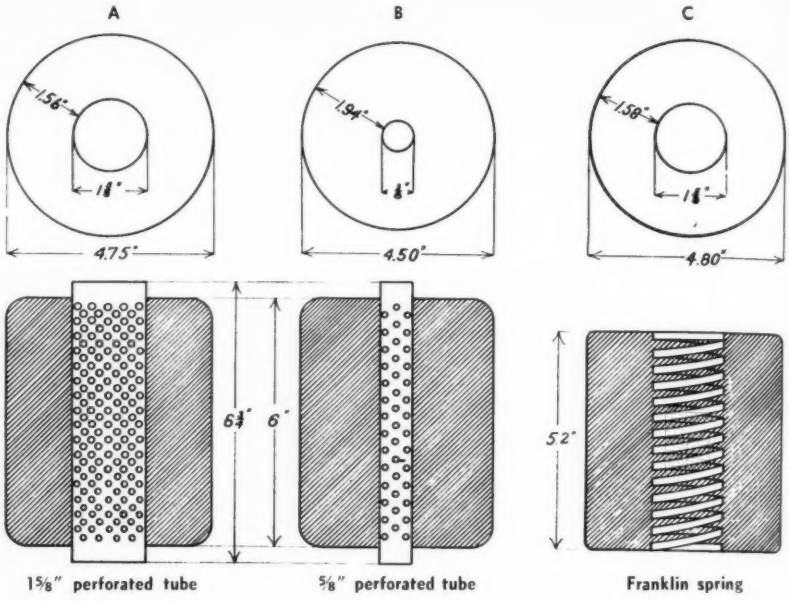

Figure 2

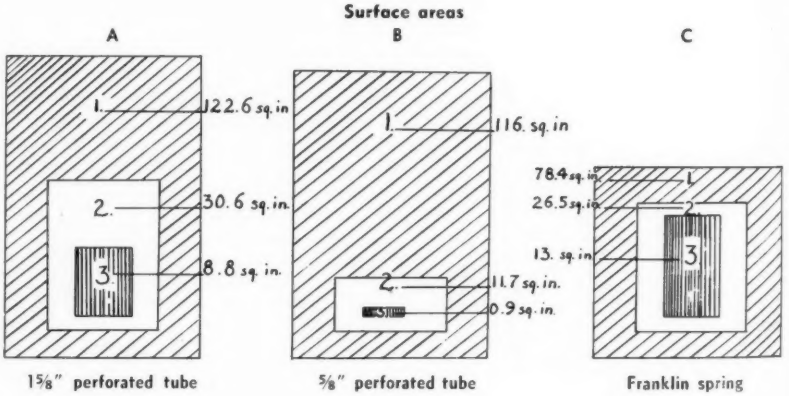

Figure 3

time on cotton while the dotted lines represent dyeings on viscose. It can be seen, therefore, that it is feasible to dye a loosely wound viscose package perfectly level with a dyestuff whose stock vat will be fully soluble when added to a cold, sharpened dyebath.

After the circulation is started, the temperature is raised slowly to the desired point while exhaustion takes place. This method, however, can still result in poor dyeings if the material swells so much under the influence of cold caustic soda that free passage of the dye liquor is inhibited. In such cases it sometimes helps to raise the temperature all the way to the boil to achieve rediffusion, but only selected dyes will withstand such an elevated temperature.

PIGMENT METHOD———A safer and much more reliable process is the pigment method. True pigmenting consists of exhausting the unreduced pigment as a finely dispersed dyestuff, such as CI Vat Blue 6, onto yarn.

The pigment exhaustion can be steered with the help of temperature, a stabilizer, salt and acid to proceed as gradually as a dyeing with a direct dyestuff. After the pigment is completely exhausted and the dyebath is clear, the packages can be rinsed cold to remove the salt or, if an easily leveling dye of high leuco

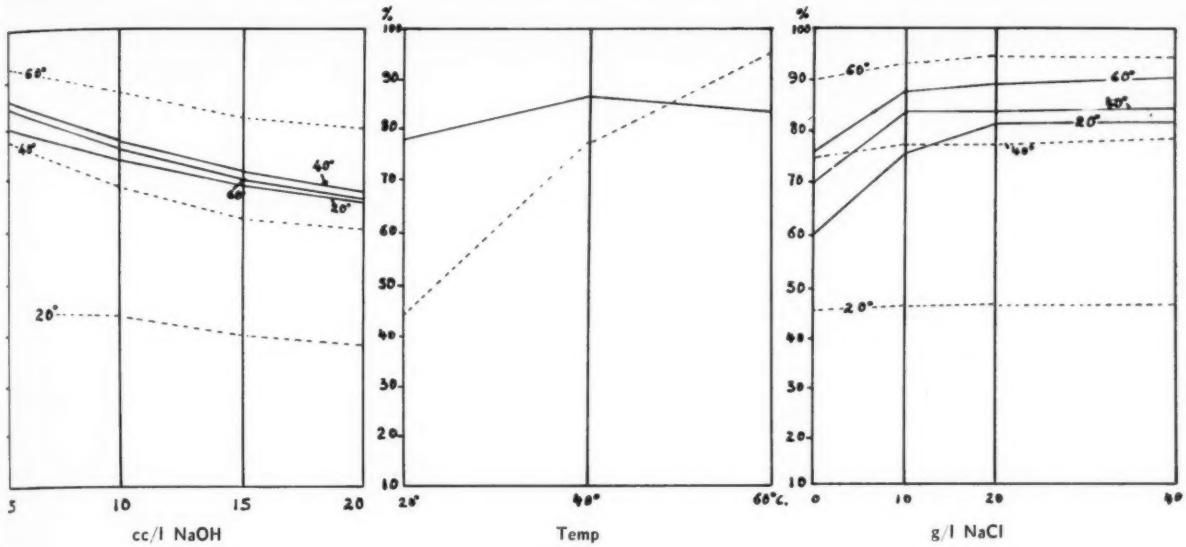

Figure 4

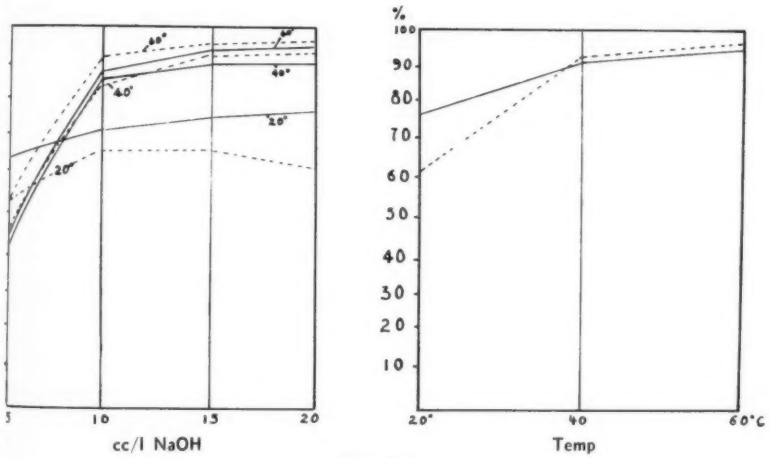

Figure 5
CI Vat Blue 20

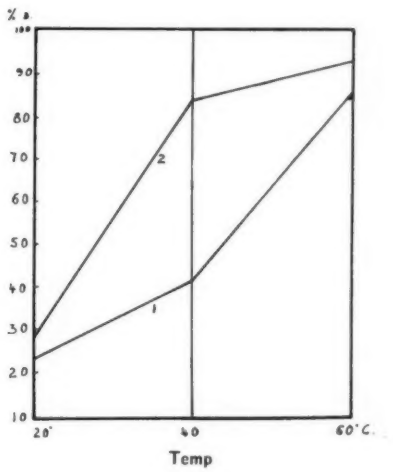

Figure 6

1) CI Vat Brown 1
2) CI Vat Red 10
Liquor ratio 1:40
5 cc/l NaOH
2.0 g/l NaCl

solubility is used, rinsing can be omitted. Caustic soda and hydrosulfite are then added in one portion to the expansion tank together with approximateiy 1/10 of previously retained pigment and reduction commences at once. If the goods have been rinsed prior to reducing, a benzimidazole sulfonate derivative may be used in this reducing bath. If the rinsing is to be omitted, glue performs very satisfactorily.

A detailed plant procedure used for dyeing a royal blue on a rather old machine follows:

Shade: Royal Blue

Material: 260 lbs of 16's combed cotton hosiery yarn wound on Franklin springs

Equipment: 250 lbs Franklin Package Dyeing Machine

Cycle: Seven minutes outside-in
Three minutes inside-out
Hand-controlled

Formula: 12.0% CI Vat Blue 6
0.8% CI Vat Violet 9
2.0 g/l stabilizer, such as Stabilizer VP Ciba
20.0 g/l common salt
1.0 cc/l acetic acid (80%)
25.0 cc/l caustic soda, 72° Tw
1.0 g/l benzimidazole sulfonate derivative, such as Albatex PO
7.0 g/l hydrosulfite

Procedure: Boil-off with 2.0% acetic acid (80%), 200° F, 30 min.
Rinse cold for 10 min.

Pigmenting: Prepare pigment dispersion in 10-gallon container. Retain one gallon of this dispersion in separate pail. Add pigment dispersion in two portions, 80° F, 10 mins. Add previously dissolved stabilizer in two portions, 80° F, 10 mins. Prepare solution of common salt and acetic acid, and add to machine over 40 min while raising temperature to 140° F, 40 mins. (At this stage the bath is completely exhausted.) Drain. Rinse cold 10 mins.

Reduction: Set new bath at 100° F. Add previously retained gallon of pigment dispersion, caustic soda, benzimidazole sulfonate derivative,

and hydrosulfite. Circulate while raising temperature to 140° F, 10 mins. Circulate at 140° F, 30 mins.

Sample: On shade. Overflow rinse inside-out without recirculation until pH is approximately 8.5—9, cold, 10 mins.

Oxidation: Set new bath with 2 g/l sodium perborate at 130° F. Circulate at 130° F for 15 mins. Add two cc/l acetic acid (80%). Circulate at 130° F for 10 mins. Drain. Rinse cold for 10 mins.

Soaping: One g/l nonionic compound, such as Ultravon JU. Two g/l soda ash at 200° F for 30 mins. Drain. Rinse free at 140° F for 15 mins.

Pigmenting methods for easy-to-dye materials do not need to be as thorough and therefore it is common practice to circulate the pigment dispersion for a while, and then follow with reduction and oxidation. In such a case, approximately 25-50% of the dye pigment is left in the bath prior to reduction and will be dyed onto the package in reduced form, relying only on the liquor flow and leveling agents for even distribution. Here again it is beneficial to choose dyes of fine particle size and of a type which indicate a not too rapid rate of strike.

The Stabilizer VP Ciba, or full pigment method is very reliable where viscose packages are involved because the dye pigment is evenly distributed in an unswollen package with acetic acid present.

A further approach to the problem of dyeing level shades if necessary on unscoured goods is by the sulfoxylate method.

SULFOXYLATE METHOD——— When sodium sulfoxylate formaldehyde instead of hydrosulfite is used in a vat dyebath, reduction takes place very gradually at temperatures above 140° F. Optimum conditions are approached at temperatures between 190-200° F. At this temperature, a redox potential (expressed in millivolts) is established which is comparable to that of a bath containing sodium hydrosulfite as a reducing agent in approximately equal quantities. However, when a vat yellow test paper is immersed, a bluish coloration takes place only after eight to ten seconds immersion.

It can be assumed that, in a sulfoxylate bath, the reduction to the leuco form of a vat dye is more a function of time-temperature than of time-alkalinity. This means that, in practice, the rate of strike is kept low in the temperature zone of 100-160° F where the most highly substantive dyes of the CI group, such as Acid Violet 34, tend to dye rapidly and do not level well. When full reduction is reached at 190-200° F, the rate of strike is still low and the ability to diffuse and level greatly enhanced. Sulfoxylate leucos are very stable and it is not necessary to add more reducing agent even after dyeing for two hours in an open machine at 200° F. In addition it is found that, unlike hydrosulfite, sulfoxylate does not form acid decomposition products to such an extent as to make pH control necessary during the duration of dyeing at high temperatures. If in heavy shades the exhaustion is relatively low with some dyes, the addition of one g/l hydrosulfite during the last 10 minutes increases the rate of strike sufficiently to clear the dyebath. The need for the "exhaustion with hydrosulfite" does not exist when viscose rayon or highly mercerized cotton is being dyed.

Another pleasing feature of sodium sulfoxylate formaldehyde is the fact that it permits dyeing with CI Vat Blue 6 at temperatures around 190° F without showing any objectionable overreduction, even in the absence of stabilizing agents.

PRACTICAL EXAMPLE———The sulfoxylate-caustic soda leuco method is ideally suited for the dyeing of lighter shades where normally leveling is a problem on cotton and viscose packages and raw stock. A typical plant procedure for the production of a helio shade on viscose carpet is as follows:

Machine: Chattanooga Raw Stock Dyeing Machine.

Formula: 0.24% Cibanone Grey 2BR Micro Powder for Dyeing. 0.05% CI Vat Violet 1

Procedure: 0.3 lbs/100 gals organic sequestering agent. 0.3 lbs/100 gals benzimidazole sulfonate derivative, such as Albatex PO. Dyestuff dispersion. Add one half into bottom part and one half into top part of the machine at 120° F for 10 mins. Circulate at 120° F for 10 mins. Add four lbs/100 gals caustic soda, five lbs/100 gals sodium sulfoxylate-formaldehyde at 120° F for 10 mins. Raise to 200° F in 30 mins. Circulate 200° F for 30 mins. Overflow rinse cold for 10 mins. Blow-down. Three lbs/100 gals sodium bicarbonate, cold, 10 mins. Blow-down. One to two lbs/100 gals hydrogen peroxide, 0.3 lbs/100 gals sequestering agent, 120° F 10 mins. Raise to 160° F in 20 mins. Add one lb/-100 gals nonionic compound, such as Ultravon JU. Raise to 180° F. Blow-down. Running wash, cold, 15 mins. Three lbs/100 gals common salt, cold, 10 mins.

RESULT———The stock was level throughout and had good spinning properties, mostly owing to the fact that no excessive blending was necessary previous to spinning.

When the above method is used to dye cotton, the goods should be prescoured. However, for cotton raw stock of average quality, scouring can often be omitted.

VISCOSE RAYON CAKE DYEING———Because of their large size (approximately 560 grams) and their small traverse angle (10°), viscose cakes of 150/36 denier are generally considered unfit for vat dyeing in a machine having a one-way flow and operating at normal atmospheric pressure. A vat dyebath, being alkaline, causes these cakes to swell to a brick-like density. When a cake dyed by the hydrosulfite-caustic soda method is examined, it always shows very severe "rings" and undyed areas.

Unlike hydrosulfite, sulfoxylate is relatively stable in an alkali-free bath and has the ability to reduce many vat dyes directly from the pigment into the vat acid form. (Figures 7 and 8).

This fact permitted us to solve the above problem by the impregnation of the relatively unswollen cake with the pigment plus sulfoxylate, converting the pigment to the still more finely distributed vat acid, and achieving final dyeing by drip feeding caustic soda at high temperatures. Cakes dyed by this method are level.

It is, of course, necessary to select dyestuffs carefully, since not all vat dyes are suitable for application by this process. Suitable dyes should have the finest possible particle size.

A method giving good results under plant conditions is as follows:

Procedure: Steep cakes in water without circulating and without tightening the plastic holders, 200° F, 30 mins. Circulate at 200° F for 10 mins. Drain. Rinse cold 10 mins. Set new bath with 0.75 cc/l acetic acid 56%, 6-10 g/l sodium sulfoxylate formaldehyde, and 1.0 g/l benzimidazole sulfonate derivative at 70° F for 20 mins. Disperse 1.0% CI Vat Brown 3 previously dispersed at a temperature below 120° F and add slowly over a period of 20 minutes. Raise to 200° F in 60 mins. Circulate at 200° F for 20 mins. Add by drip feeding six cc/l caustic soda, 66° Tw, 200° F,

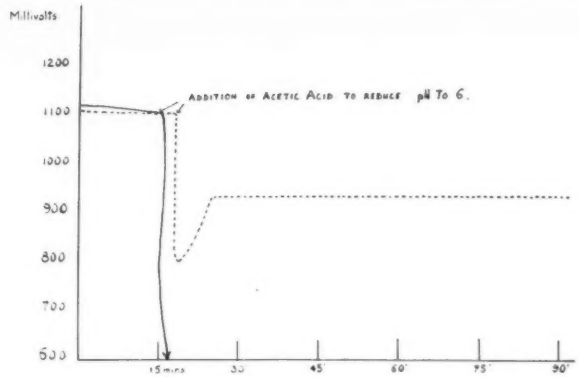

Figure 7
Redox potential in millivolts vs time at 200° F constant temp

——— 4 g/l hydrosulfite — NaOH
- - - - - - 4 g/l sulfoxylate — NaOH

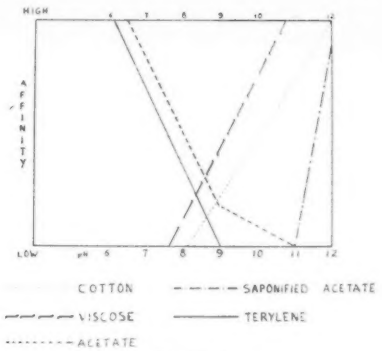

Figure 8
Influence of pH on affinity

30 mins. Circulate, 200° F, 60 mins. Add water to lower temperature to 160° F in 20 mins. Drain. Rinse at 130° F for 10 mins. Drain. Add 2.5 g/l sodium bicarbonate at 90° F for 20 mins. Drain. Rinse at 90° F for 10 mins. Drain. Add one g/l hydrogen peroxide at 90° F for five mins. Raise to 160° F in five mins. Add 0.5 g/l detergent. Raise to 200° F in five mins. Circulate at 200° F for 20 mins. Drain. Rinse. Finish off.

A number of vat dyes dye very satisfactorily, even when the above method is altered in the following respects:

Wetting-out: As above.

Dyeing: 0.75 cc/l acetic acid (56%), 1.0 g/l benzimidazole sulfonate derivative, 70° F, 20 mins. Add dispersed dyestuff (1.0% Vat Yellow 2) as described above. pH should be between 6 and 7. Circulate while raising temperature to 200° F in 60 mins. Add by drip feeding 10 cc/l caustic soda, 66° Tw, 10 g/l sodium sulfoxylate formaldehyde, 200° F, 30 mins. Circulate and continue as described above.

It has been found that the speed of reduction of vat dyes by sodium sulfoxylate formaldehyde is influenced by the turbulence of the dye liquor.

One mill installed a Venturi tube at the entrance to a raw stock kier and found that the time for obtaining full reduction was cut at least in half. On the other hand, we once encountered a machine with such a slow liquor flow, nearly free from turbulence, that only a small addition of sodium hydrosulfite at 200° F was able to trigger proper reduction.

In addition to the methods discussed in this paper, there are, of course, other approaches possible. The vat acid method, stock vat exhaustion method, and others are being used successfully. The scope of this paper, however, does not permit us to discuss them all in detail.

Before concluding, let us discuss briefly the most common selection of anthraquinone vat dyes which are generally used in package dyehouses.

CI Vat Yellow 2. Bright, levels at increased dyeing temperature. Lacks fastness to light, economical.

CI Vat Yellow 23. Good leveling, all-round workhorse color. Can be used for shading.

Anthraquinone Vat Yellow PGA (Pr 600). This is a level dyeing, economical and easy-oxidizing dyestuff of the shade of CI Vat Yellow 2. The "PGA" type is not phototropic.

CI Vat Orange 11. Used for shading or for fast-to-weathering self shades. When used in combinations, it increases the lightfastness of the combination. Leuco is stable at 180° F. Slightly sensitive to copper.

CI Vat Orange 15. Very easy to level, good shading color. Very difficult to rinse after dyeing in heavier shades since leuco rinses off. Does not change shade in soaping. Fast to weathering.

CI Vat Orange 9. Hot dyeing type. Easy to rinse in heavy shades. Changes shade in soaping.

CI Vat Orange 2. Excellent working properties and money value. Used widely. Leuco is stable at 180° F.

CI Vat Orange 3. Cold dyeing type of low substantivity. Fast to weathering. Needs vacuum extraction in heavy shades for oxidation since difficult to rinse.

CI Vat Orange 7. Hot dyeing type of great brightness, lightfastness and economy. Easy working properties. Not fast to weathering.

CI Vat Brown 3. Very level dyeing. Used widely in combination with CI Vat Green 1 and CI Vat Black 29 for fashion shades of best levelness. Fast to weathering. Excellent shading dye. Used for upholstery, towelling and knitting yarns.

CI Vat Brown 1. Level dyeing, high tinctorial value, used as a base for many brown shades. Fast to weathering.

CI Vat Brown 36. Good leveling package-dyeing color. Suitable for shading and often used for reddening of fawn and tan shades.

CI Vat Brown 35. One of the most versatile shading dyes since it yields equally good results by all dyeing methods. Used for tan shades and light browns where leveling and top fastness is demanded.

CI Vat Red 10. Popular shading color and level dyeing base for pink and rose shades.

CI Vat Red 24. Very level dyeing, fast to weathering. Nontendering browns are produced in combination with CI Vat Brown 3 and CI Vat Black 27.

CI Vat Violet 13. Most level dyeing vat violet. Good tinctorial value and fastness to water spotting, heat and light. Not too bright in shade.

CI Vat Violet 9. Bright productive violet used mainly for shading blues. Reddens with chlorine off-setting greening of the blues. Dyes unlevel in pale shades without, but perfectly level with benzimidazole sulfonate derivatives.

CI Vat Blue 5. Permits the production of the cheapest vat royal blues. Used in the USA for knit goods when top lightfastness is not required.

CI Vat Blue 4. This is the pure form of indanthrone and very unstable in leuco form. Seldom used in package dyeing since it tends to crys-

tallize in the leuco form if used in high concentrations.

CI Vat Blue 14. Monochlorindanthrone of better stability than CI Vat Blue 4. Bright. GCD type.

CI Vat Blue 6. (CI 69825 special preparation). Dichlorindanthrone having the best all-round fastness and leuco stability of the indanthrone blues and used most widely.

CI Vat Blue 6. (CI 69825). Trichlorindanthrone. This type has similar properties to the GCD type, but slightly lower leuco stability and is very sensitive to hard water.

All indanthrone blues require high amounts of caustic soda to form the leuco. In addition, they are temperature sensitive. Their leuco, not being very soluble, is electrolyte sensitive. These factors cause a vicious circle, which is often difficult to break when dyeing heavy shades.

The stabilizer method in conjunction with a micro disperse type usually assures the best results.

CI Vat Green 1. According to Whittaker: "the gentleman of the vat dyes". Dyes by all dyeing methods and is one of the most widely used products. (See Figure 9).

CI Vat Green 4. Does not level easily without leveling agents. Excellent all-round fastness. Like CI Vat Orange 11 and CI Vat Blue 18, it imparts a protective action against tendering to combinations in which it is present. Good money value; fast to weathering.

CI Vat Black 27. Popular shading dye since it is applicable by all three dyeing methods. Easy to level. Slightly sensitive to copper. Used widely in combination shades.

CI Vat Black 29. Used as an easy leveling blue component in combinations and as a self shade.

CI Vat Black 30. Top fastness. This dye darkens infra-red reflectancy when added to combinations. Easy to level for high quality work.

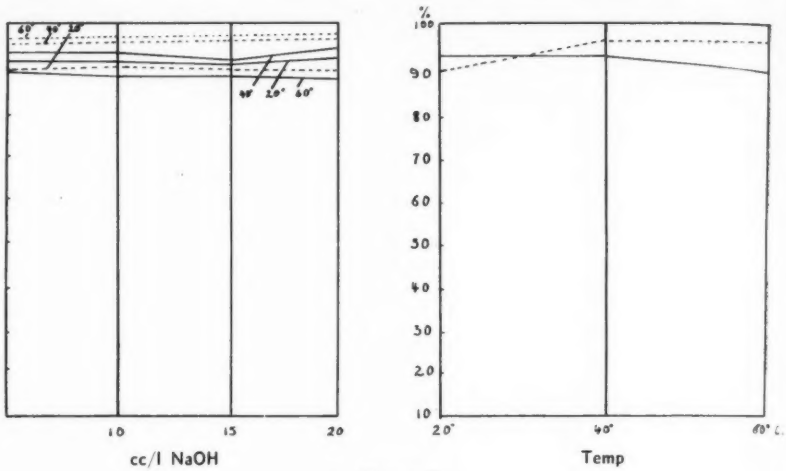

Figure 9
CI Vat Green 1

CI Vat Green 9. Most economical vat black when oxidized with chlorine. In combination with CI Vat Blue 20, it is sometimes used for producing navies and direct dyeing blacks.

CI Vat Black. 9. This is the only homogeneous direct dyeing vat black available. Excellent leveling color. Used for producing economical grey and charcoal shades. Rarely used as a black for cost reasons.

CONCLUSION

I have tried to show that the rate of strike, flow pattern, as determined by the nature of the package, leveling agents, temperature, pigmenting, or modifications of the leuco form are all interlocking factors in package dyeing. The control of these factors, together with careful selection of dyestuffs, are the dyer's tools for producing high-quality vat-dyed yarns.

However, in addition to the dyer's skill, common sense and teamwork in all departments of the mill—not only in the dyehouse—are necessary to assure final success.

If the Sales Department makes impractical or impossible promises, or if the Winding Department disregards dyehouse requirements, even the best dyer will have difficulties.

The dyestuff suppliers too, can make their contribution by making available to the dyer all the information necessary for him to do a first-class job with their products.

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(2) AATCC Monograph No. 2, "The Application of Vat Dyes."
(3) Desirens, L, "Chemical Technology of Dyeing and Printing," Vol II, Reinhold, New York, 1948.
(4) 2nd Edition, "Colour Index," AATCC & SDC.
(5) Bardt, Klaus J, "Dyeing Cellulosic and Noncellulosic Fibers with Vat Dyes," *Can Textile J*, Oct 4, 1957.

AATCC Calendar

COUNCIL, COUNCIL COMMITTEES, RESEARCH COMMITTEES
April 1-3 (Hotel McAlpin, New York, NY)
April 1—Research Committees
April 2—Council Committees, TCR, ECR
April 3 (AM)—Council Meeting
May 29, 1959 (Mount Royal Hotel, Montreal, Canada) AM-Council meeting; PM-Joint luncheon and technical session with CATCC

NATIONAL CONVENTIONS
Oct 8-10, 1959 (Sheraton Park and Shoreham Hotels, Washington, DC); Oct 6-8, 1960 (Sheraton Hotel, Philadelphia, Pa.); September 28-30, 1961 (Buffalo, NY); 1962 (Southern Region)

DELAWARE VALLEY SECTION
Apr 11 (Ladies Night—Kugler's); May 22 (Annual Outing—Philmont Country Club, Huntingdon Valley, Pa)

HUDSON-MOHAWK SECTION
April 3 (Chelsea House, Tribes Hill, NY); May 22 (Ladies night, Schuyler Meadow Country Club, Albany, NY); June 26 (Annual outing—Antlers Country Club, Amsterdam, NY)

METROPOLITAN SECTION
Apr 10, May 8 (Kohler's Swiss Chalet, Rochelle Park, NJ); June 12 (Outing)

MID-WEST SECTION
April 25 (Schroeder Hotel, Milwaukee, Wis); June 12-13 (Outing—Brown Lake Resort, Burlington, Wis); Oct 24 (Bismarck Hotel, Chicago, Ill)

NIAGARA FRONTIER SECTION
April 4 (Hamilton, Ont—joint meeting with Ontario Section, CATCC

PIEDMONT SECTION
April 10-11 (Robert E Lee Hotel, Winston-Salem, NC); June 5-7 (Outing—Grove Park Inn, Asheville, NC); Sept 25-26 (Barringer Hotel, Charlotte, NC)

RHODE ISLAND SECTION
Apr 24 (Student Night); June 12 (26th Annual Outing, Metacomet CC); Sept 18 (Management Night); Oct 23 (Prov Eng Soc, Providence, RI); Dec 4 (Annual Meeting—Johnson's Hummocks Grille, Providence, RI)

SOUTH CENTRAL SECTION
Sept 19 (Hotel Patten, Chattanooga, Tenn); June 26-27 (Outing—Riverside Hotel, Gatlinburg, Tenn)

SOUTHEASTERN SECTION
April 18 (National Guard Armory, Cedartown, Ga); June 12-14 (Summer Outing—Radium Springs, Ga); Sept 12 (Ida Cason Callaway Gardens, Pine Mtn, Ga); Dec 5 (Atlanta, Ga)

WESTERN NEW ENGLAND SECTION
Apr 17 (Rapp's Restaurant, Shelton, Conn); May 15 (Ladies' Night—Rapp's Paradise Inn, Ansonia, Conn); June 12 (Outing—Wallingford, Conn); Sept 25 (Blake's Restaurant, Springfield, Mass); Oct 23 (Annual Meeting—Rapp's Restaurant, Shelton, Conn); Dec 4 (Hartford, Conn)

37th National Convention———

THE PRACTICAL APPLICATION AND CONTROL OF DIELDRIN FOR DURABLE MOTHPROOFING*

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Textile Chemical Dept
E F Drew & Co, Inc

Dieldrin is available from many chemical suppliers as a 20% emulsifiable concentrate, Shell Chemical Corp is the sole supplier of Dieldrin.

The paper shows that Dieldrin strikes very fast on wool from an aqueous phase and that this fast strike may be utilized for continuous application; however, it must be carefully controlled for even application in batch-dyeing operations.

In a suitable nonionic emulsion system, pH of the liquor has no effect. The effect of temperature of application is noted, and liquor ratio is shown to be the greatest variable. Other emulsion systems are considered.

These methods of application are easily understood, but a tight control by quantitative analysis is essential to deliver, to the end user, wool containing 0.05%± 0.01% Dieldrin, the amount required to satisfy the Federal Trade Commission in the United States and the Department of Agriculture in Canada in order that the garment may be advertised as permanently or durably mothproofed for the normal life of the garment.

INTRODUCTION

DIELDRIN is a chlorinated hydrocarbon. Specifically it is a mixture of 85% HEOD (Hexachloroepoxyoctahydro-endo, exo-dimethanonapthalene) and 15% insecticidally active chlorinated hydrocarbons. It is a solid white amorphous material. The setting point is 203°F. It is relatively insoluble in water, the solubility being 0.1 ppm. When added in solid form to a Florence Flask and boiled for eight hours, 2% is distilled over into the trap in the first 20 minutes, after which there is no further loss. Dieldrin is an American invention, which was first produced by the Heineman Co, Denver, Colo, which is now a part of the worldwide Shell organization. It is widely used as an insecticide on all types of field crops, including cotton, peaches, apples, etc. It is used for the control of mosquitoes in the East Indies where, thanks to Dieldrin, 10,000,000 people have escaped death from malaria. The United States Department of Agriculture is treating 20,000,000 acres in eight southern states with the dosage of two pounds of Dieldrin per acre to eradicate the fire ant. The low amount used attests to its efficacy as an insecticide.

An Australian research project to invent or select a suitable inexpensive mothproofing agent for wool culminated with the selection of Dieldrin, prepared in the form of a self-emulsifiable concentrate for application in the dyebath, backwashing machine for top, or in the continuous scouring machine for woolen skeins.

Lipson and colleagues in Australia have reported on their work to date (*1*). Mitchell and Williams (*2*) in this country have reported on the fact that, when applied in the dyebath, Dieldrin passed all ASTM tests (D-627-54) for a satisfactory mothproofing agent; and, in addition, the product is fast to 20 cycles of hand washings and 25 drycleanings and still shows a satisfactory resistance to moths and carpet beetles. ASTM D-627-54 calls for five washings and five drycleanings.

It is the purpose of this paper to present an interim report only on the actual mechanics of application of Dieldrin to wool, and to cover actual methods of application which have given fairly even distribution and a requisite degree of fastness in processing over 50,000,000 pounds of wool in the past few months in the United States.

DISCUSSION

ANALYSIS OF DIELDRIN ON THE WOOL AND IN PROCESSING LIQUORS———One disadvantage is the difficulty of analytical control of the Dieldrin deposited on the wool or of that remaining in the liquor. Few mills are equipped with an infra-red spectrophotometer, and even with this piece of equipment available, dyestuffs, wool oils and wool greases, even in small amounts, interfere with determinations. The phenyl azide method (*3*), which is specific for Dieldrin, takes three days to complete and the technique is exceedingly difficult. This is reflected in the fact that commercial laboratories in the United States charge $50-$100 per determination by this method.

A simple method used for the identification of pure Dieldrin is based on the fact that Dieldrin dissolved in xylene gives a red color with fuming sulfuric acid (*4*). Unfortunately it cannot be easily adopted for control in a textile mill. We have found that the presence of small amounts of residual soap or small amounts of residual wool grease interfere severely in adapting this process for use in commercial production of mothproofing worsted top in the backwasher, even when such top has been scoured at the raw wool stage with nonionic detergents to ether extractions as low as 0.4%.

Attempts were made to standardize for constant grease content of the wool and allow for the brownish cast of the characteristic pink color by using the General Electric Spectrophotometer, but no satisfactory method could be worked out. It is thought that the brownish cast is due to the sulfonation of the wool grease by the fuming sulfuric acid. This analytical method is still under review.

Early in 1957, we developed an analytical procedure, based on a total chlorine method used for other chlorinated hydrocarbons. The technique employed has been adopted to wool and improved so that the reproducibility is about 95%. The method is as follows:

Add 20 grams of wool to 15% boiling caustic solution, immediately remove heat and allow to digest and cool. Extract the Dieldrin with four ether washings. Now wash the ether extraction with water to remove water-soluble chlorides and other material. Transfer the ether extraction to the nickel container of a Parr

*Presented on October 31, 1958 during the 37th National Convention at the Conrad Hilton Hotel, Chicago, Ill.

Bomb apparatus. Evaporate the ether, add sodium peroxide, some sucrose, fire the bomb. Wash the fused contents with distilled water, neutralize the alkali with nitric 1:1 to yellow-green end point using bromphenol blue as indicator, titrate with mercuric nitrate using diphenylcarbazone as indicator. Determine chlorine content and titrate as Dieldrin.

The method gives excellent results in the hands of a good analyst who will develop the necessary techniques to break the emulsions formed by extracted dyestuffs with ether, etc. The analyst will familiarize himself by running blanks with known amounts of pure Dieldrin to check the end point, and with untreated wool. The reagent blank is equivalent to 0.003% Dieldrin and pure untreated botany flannel is equivalent to 0.001% Dieldrin. Hence 0.004% Dieldrin is deducted from all results. 0.001% Dieldrin is equivalent to 0.1 pound, 20% Dieldrin per 1000 US gallons. For the last several months more than 100 analyses per week have been run using this technique and it has proved to be most satisfactory. There is good correlation between laboratories. In this respect it is more accurate than infra-red or phenyl azide. This method still consumes a lot of time and the commercial cost of analysis is $10 per determination. An effective, quick, inexpensive method to analyse the Dieldrin on the wool is still of paramount importance. Paper chromatography and X-ray diffraction analysis and radio-active isotopes are all advanced research tools to determine Dieldrin content.

Untreated nylon, cotton, viscose, Dacron, and Orlon are equivalent to 0.01% Dieldrin (approx) and show no increased pick up when dyed at pH 7.0 in presence of Dieldrin. The same conditions hold true at pH 2.0, except for nylon, which in an acid (metallized) dyebath picked up 10% more Dieldrin than the wool. This experience with blends is recounted as indicative only, as it has not yet been thoroughly investigated. There is some evidence that weave and construction should be considered also. Dieldrin has no "blocking effect" on nylon in a nylon/wool dyebath.

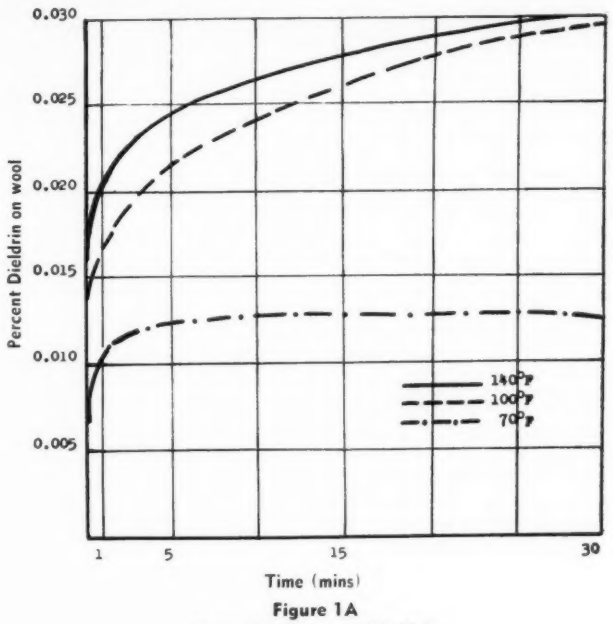

Figure 1A
Rate of exhaust of Dieldrin
pH 7.0, liquor ratio 20:1
Four ozs 20% self-emulsifiable Dieldrin/100 lbs wool

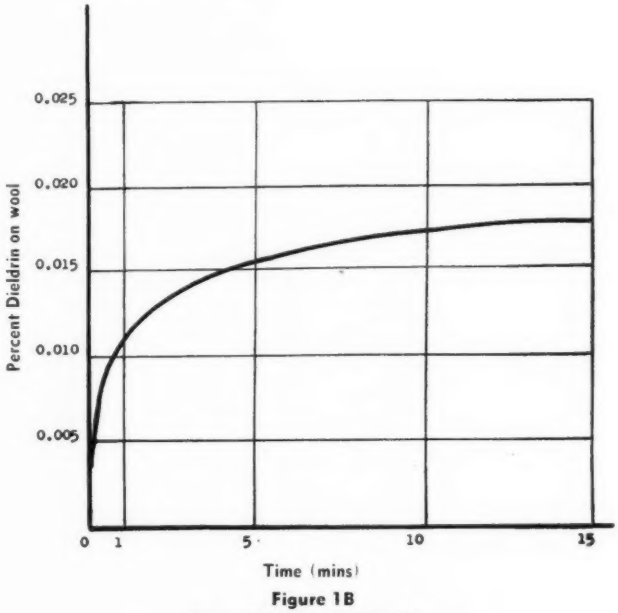

Figure 1B
Rate of exhaust of Dieldrin
pH 4.0, liquor ratio 20:1, temp 70° F
Four ozs 20% self-emulsifiable Dieldrin/100 lbs wool

SELF-EMULSIFIABLE DIELDRIN CONCENTRATE AND THE EFFECT OF EMULSIFIERS——Dieldrin is prepared for textile application by dissolving in a suitable solvent, and adding nonionic, anionic or cationic emulsifiers or suitable mixtures of them, depending on the requirements of the emulsion system, which is usually dictated by the method of application, specifically the condition of liquor ratio, temperature, time, pH, etc.

Emulsifiers effect the system as follows:

Too much emulsifier will suspend the Dieldrin and give a low yield. Too little emulsifier will interfere with penetration in raw stock kettle dyeing and in package dyeing. Too little emulsifier is "drowned" in long liquor ratios, the Dieldrin drops out of emulsion, is not detected in ana-

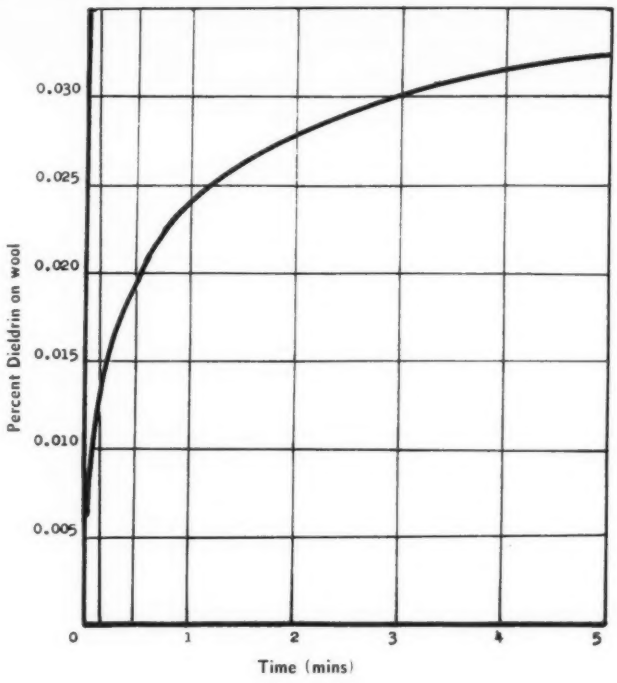

Figure 1C

Rate of exhaust of Dieldrin

pH 2.0, liquor ratio 20:1, temp 200° F
Four ozs 20% self-emulsifiable Dieldrin/100 lbs wool

TABLE I

Application of Dieldrin from self-emulsifiable xylene, using nonionic emulsifier

RATE OF PICKUP OF DIELDRIN ON BOTANY WOOL FLANNEL

Standard Conditions:
20:1 liquor ratio
Four ozs 20% Dieldrin per 100 lbs = 0.05% at 100% yield on wt of fabric

		Percent Dieldrin at			
pH	*Time (mins)*	*70° F*	*100° F*	*140° F*	*200° F*
7.0	0.5	0.011	0.017	0.020	
	1.0	0.010	0.017	0.022	
	5.0	0.013	0.018	0.024	
	15.0	0.010	0.029	0.027	
	30.0	0.012	0.029	0.030	
4.0	0.5	0.014			
	1.0	0.007			
	5.0	0.018			
	15.0	0.012			
2.0	0.167				0.016
	0.5				0.018
	1.0				0.025
	5.0				0.032

Yield: 0.012% = 24% yield
0.029% = 58% "
0.030% = 60% "
0.032% = 64% "

lysis of the liquor, and gives a low yield on the wool. The drowning of the emulsion in the dyehouse effluent system may explain a complete lack of any evidence of fish damage in streams and rivers. Wherever possible, the process is designed to obtain maximum exhaustion of the Dieldrin by the wool, in order to avoid possible effluent problems, which are under scrutiny. The anionic and cationic emulsifying systems tested to date do not yet equal the results of nonionic systems in fastness to washing of the Dieldrin on the fiber.

The rate of strike of Dieldrin is generally the same for any given condition of pH, liquor ratio, time, temperature. It does not depend on a nonionic, cationic or anionic system, but rather rests on the inherent attraction of Dieldrin for wool; however, the nature of the emulsifying system does effect yield. Therefore, precautions for even application must be taken with every emulsifying system. There is some limited evidence that cationic and anionic systems tend to give better distribution of Dieldrin, but this is not as important as fastness.

The use of certain resins to stabilize agricultural sprays should not be used for textile application of Dieldrin because their presence gives trouble in the napping of blankets, coatings, etc, imparts a gummy feeling, and shows up as poor soil repellancy on carpets.

LABORATORY AND TEXTILE PLANT EXPERIENCE WITH DIELDRIN APPLIED FROM NONIONIC EMULSIFYING SYSTEM. FASTNESS TO WASHING, ETC——The emulsifiers mentioned in the remainder of this paper are nonionic, and all results covered therefore pertain to that nonionic system and may not be representative of what happens with other emulsion systems.

To determine the mechanics of application the following work was carried out.

Figures 1A, 1B, and 1C and Table I illustrate the rate of pickup at different conditions of temperature and pH. The very fast strike at any temperature dictates that the Dieldrin should be added very slowly and evenly to batch operations in order to get even pickup, or must be added very evenly across open-width pieces in continuous application, in order to obtain even distribution. The fact that the yield at 20:1 is

24% at 70°F
58% at 100°F
60% at 140°F
64% at 200°F

means that addition to the cold dyebath offers a method of controlling or obtaining even pickup. These figures are chiefly applicable to a regular piece-dyebath application. There has been little evidence of migration in the dyebath, but this has not been thoroughly investigated. Evenness of application is essential at any temperature and uneven application does not appear to be corrected by migration in the dyebath.

Routine laboratory evaluation of this product in every conceivable textile application in the laboratory indicated that the fastness to washing was very good, and a practical mill trial was made to evaluate the difference in washfastness between application at the boil in the dyebath and application in the last rinse at 110°F. After twenty washings they show equal and adequate protection against moth damage.

TABLE II

Fastness to washing of 20% self-emulsifiable Dieldrin-treated socks. Application in dyebath for one hour at 200° F, pH 2, pH 4, pH 6 vs application in finish bath at 110° F for 15 minutes

Ounces 20% self-emulsifiable Dieldrin per 100 lbs socks	Point of application: Liquor ratio	Point of application: Acid dyebath	Point of application: Last rinse finish after bleach	Percent Dieldrin before hand washing	Milligrams excrement and visual rating by U S Testing Co untreated = 15.2 mg excrement Washing cycles**: 5	10	15	20	Percent Dieldrin after 20 washing cycles
4	20:1	scarlet pH 2.6		0.041	1.8 good	5.1 good	7.3 poor	4.4 good	0.01
8	19:1	black* pH 4.0			3.0 good	3.0 good	3.4 good	2.3 good	
6	30:1	royal blue pH 6.0			1.0 good	2.7 good	4.6 good	4.1 good	0.008
4	16:1	royal blue pH 6.0		0.031	4.9 good	1.2 good	3.3 good	2.3 good	
4	12:1		with 0.5% cationic finish	0.039	2.2 good	2.2 good	3.0 good	2.3 good	0.016
4	12:1		0.6% anionic finish					3.8 good	0.009
4	12:1		0.6% nonionic finish					3.0 good	0.01
8	12:1		0.5% cationic finish	0.058	2.4 good	2.4 good	2.1 good	2.7 good	0.017

*Chlorinated before dyeing.
**One washing cycle = Two gpl Lux soap, five min, 95° F ± 5° F. Two one-min rinses.

TABLE III

Persistence of mothproofing effect after 20 wash cycles. Blankets treated at 70° for 15 mins, liquor ratio 5:1, pH 2.0. Mothproof test by ASTM designation D-582-54. Results as mg excrement.

APPLIED IN LAST RINSE IN DOLLY WASHER

Color	Untreated sample	Washing before	5	10	15	20
Peach	15 mg	1.4 mg good	2.0 mg good			
Pale blue	15 mg	1.6 mg good	1.3 mg good			
Yellow	15 mg	1.0 mg good	1.9 mg good	1.0 mg good	1.7 mg good	2.2 mg good
Cream	15 mg	1.8 mg good	2.0 mg good			

Applied four-ozs 20% self-emulsifiable Dieldrin per 100 lbs wool at 70° F.
One washing cycle: two gpl Lux, 95° F ± 5° F, five mins; two rinses, one min each.
Gyrator-type home laundry machine.
Carpet beetle tests and visual rating by U S Testing Co.
20% Self-emulsifiable Dieldrin added during three mins, ran 12 mins more. (15 Minutes total time).

TABLE IV

Eight-ozs 20% self-emulsifiable Dieldrin per 100 lbs wool. The effect of time and pH on the pickup of Dieldrin by Botany wool fabric from a 20% self-emulsifiable Dieldrin bath. Dolly washer application.

	Percent Dieldrin on weight of fabric								
	pH 7.0			pH 4.0			pH 2.0		
Liquor ratio	15 mins	30 mins	60 mins	15 mins	30 mins	60 mins	15 mins	30 mins	60 mins
5:1	0.071	0.067	—	0.044	0.065	—	0.059	0.059	—
10:1	0.046	0.032	—	0.061	0.080	—	0.048	0.064	—
20:1	0.027	0.039	0.030	0.029	0.033	0.030	0.064	0.025	0.053
50:1	0.027	0.041	0.032	0.031	0.026	0.026	0.023	0.022	0.041
100:1	0.028	0.021	0.025	0.033	0.030	0.033	0.022	0.027	0.058*

*This value is rejected for computation since its deviation is greater than that expected by normal probability. See Wendell & Severinghaus, "Precision of Measurements".

Fastness to Washing—Dyebath at Boil vs Last Rinse at 110°F. Table II gives the results.

Dolly Washer Application. Table III illustrates that, with low liquor ratio at low pH, it is possible to obtain good yield and fixation at temperatures as low as 70°F.

To obtain the necessary background for the widely used dolly washer application, it was decided to investigate in the laboratory the effects of liquor ratio, pH, and time of pickup of Dieldrin at 100°F.

LABORATORY INVESTIGATION. THE EFFECT OF LIQUOR RATIO, TIME AND pH ON THE PICK-UP OF DIELDRIN BY BOTANY WOOL FABRIC FROM A DREWCLAD 2* BATH AT 100°F———

Dolly Washer Application:

Standard Conditions: Eight ozs Drewclad per 100 lbs wool. 100°F. AATCC botany flannel, nonionic scoured, and equilibrated to required pH condition.

*Drewclad 2 is 20% self-emulsifiable Dieldrin, using nonionic emulsifiers.

Procedure: Add eight ozs Drewclad to five gallons cold water. Feed slowly, evenly, continuously during 10 minutes.

Varying Conditions:

Liquor ratios: 5:1, 10:1, 20-1, 50:1, 100:1.

pH conditions: pH 7.0, pH 4.0, pH 2.0.

Time: 15 min, 30 min, 60 min.

The results shown in Table IV and in Figure 2 illustrate that, using eight ozs 20% self-emulsifiable Dieldrin per 100 lbs fabric, the liquor ratio should be between 17.5:1 and 5:1 in order to deposit 0.04%-0.06% (0.05% ± 0.01%) on the fiber, using Drewclad 2.

RESULTS OF LABORATORY INVESTIGATION ——— The scoured flannel samples were equilibrated at the pH values of 7.0, 4.0, and 2.0.

The Drewclad was then applied in diluted form at the rate of five gallons of cold water for each eight ounces of Drewclad. This diluted Drewclad was added slowly and evenly during 10 minutes for each of the pH levels, liquor ratios, and time periods involved in the experiment.

Consideration of the results may be facilitated by summing all values associated with each main effect as follows:

Sum of 13 values of pH 7.0 = .486. Average = 0.037%.

Sum of 13 values of pH 4.0 = .521. Average = 0.040%.

Sum of 13 values of pH 2.0 = .565. Average = 0.043%.

From this, it is seen that the pH effect on the Dieldrin pickup is small.

The importance of absence of pH effect is reflected in the fact that an equal yield of Dieldrin is obtained from: chrome-complex dyes applied at pH 2; strong acid dyes applied at pH 2-pH 3; weak acid dyes applied at pH 4.0; milling dyes applied at pH 5.0; premetallized dyes applied at pH 6-pH 7.0. (See Table V for actual and typical example of commercial experience of this condition).

If the results are summed as to period of application, we have:

Sum of 15 values of 15 minutes = 0.613. Average—0.041%.

Sum of 15 values of 30 minutes = 0.631. Average—0.042%.

Sum of nine values of 60 minutes = 0.328. Average—0.036%.

Again period of application has but a small effect on pickup of Dieldrin.

In similar manner, the sums of the different levels of liquor-goods ratio indicate as follows:

Sum of six values of 5:1 ratio = 0.365. Average = 0.061%.

Sum of six values of 10:1 ratio = 0.331. Average = 0.055%.

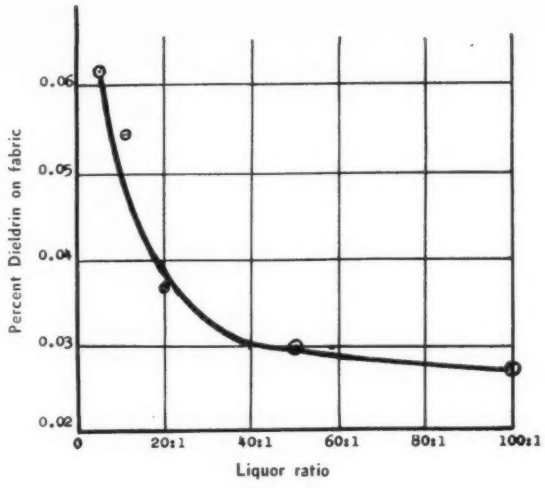

Figure 2

Dieldrin pickup as a function of liquor ratio on a dolly washer at 100° F

Eight ozs 20% self-emulsifiable Dieldrin/100 lbs wool

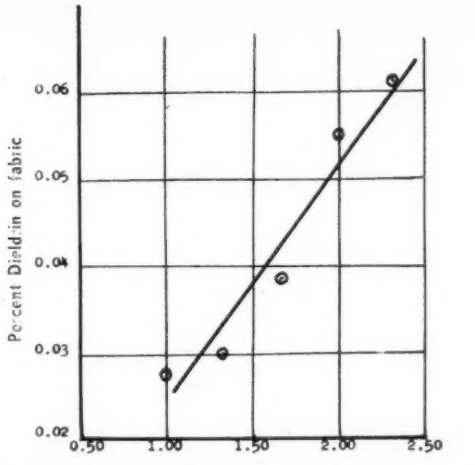

Figure 3

Dieldrin pickup from nonionic system showing dependency on law of mass action

Sum of nine values of 20:1 ratio = 0.330. Average = 0.037%.

Sum of nine values of 50:1 ratio = 0.269. Average = 0.030%.

Sum of eight values of 100:1 ratio = 0.219. Average = 0.027%.

AL—Dyestuff (3-23)—9 on 10 Tex

Here a definite change is noted among the average Dieldrin values at the various liquor ratios.

It should be noted that, in summing as above, the effects of all the factors other than the one being summed are completely randomized, with the sums secured representing an unbiased result.

If the above average Dieldrin values are listed with their respective bath *concentrations* of Drewclad in terms of mg per liter, we have:

Dieldrin (%)	*Conc Bath (mg/l)*	*Log conc bath*
0.061	200	2.301
0.055	100	2.000
0.037	50	1.699
0.030	20	1.301
0.027	10	1.000

If the percent of Dieldrin present on the fiber is plotted as the dependent variable, and the logarithm of the Dieldrin concentration in the bath as the independent variable, a straight line function is indicated. In other words, under these conditions the pickup of Dieldrin follows the mass action law and as such is dependent upon the actual concentration in the bath. This is shown in Figure 3.

One of our colleagues (5) has speculated from this and other evidence that there is no chemical attraction between wool and Dieldrin but that the attraction is by van der Waals forces, the permanency of the attraction being due to the happenstance of the particular configuration of the wool molecule and of the Dieldrin molecule, which causes a particularly tight fit which resists washing, drycleaning, etc.

One might wonder about the possibility that there are other chemicals which might demonstrate a similar attraction to wool, equal in permanence to that of Dieldrin, and which might impart new and useful properties to the fiber.

APPLICATION OF DIELDRIN IN BATCH DYEING——Variable results where application was made in the dyebath insisted that a critical look be given to that operation. Practical evidence seemed to indicate that the longer the "boil", the less the yield of Dieldrin. Table VI indicates this trend.

TABLE V

An actual and typical example of equal pickup of Dieldrin from various dyebaths, using Drewclad 2 (a nonionic emulsifying system) showing absence of effect of pH on pickup, in the same dyehouse using different dyeing methods.

HUSSONG YARN MACHINE

Type Dyeing	*Percent Dieldrin*
Acid (metallized)	0.045
Acid (metallized)	0.047
Acid	0.054
Acid	0.054
Milling	0.055
Neutral dye	0.060
Acid	0.053
Package Dyeing	
Milling	0.045
Milling	0.046
Raw Stock Kettle (Analysis made on roving (roping))	
Premetalized	0.047
Acid (metalized)	0.059
Premetalized	0.055
Milling	0.064
Premetalized	0.049

TABLE VI

Eight ozs 20% self-emulsifiable Dieldrin per 100 lbs wool

Applied cold at pH 2.6 — 20:1 Liquor ratio
Raised to boil (205° ± 3° F) in 30 minutes
Piece goods in totally enclosed dye kettle

Time at boil	*Percent Dieldrin*
10 mins	0.065
1 hr	0.052
3 hrs	0.038

Note: At this point we are not sure if the progressive loss is due to loss of efficiency of nonionic emulsifiers at or above their cloud points or due to loss by steam distillation.

The favored technique of adding the Dieldrin at the end of the dye cycle overcomes this disadvantage.

Practical results show that the amounts of 20% self-emulsifiable Dieldrin required to deposit 0.05% ± 0.01% Dieldrin on the wool (one hour at the boil) are as shown in Table VII.

TABLE VII

Typical mill application	*Liquor ratio*	*20% self-emulsifiable Dieldrin in ozs per 100 lbs wool*
Raw stock dyeing or package dyeing	8:1—10:1	4
	15:1—	5
Piece dyeing	15:1	5
	20:1	6
	50:1	8
Yarn dyeing—Hussong type	30:1	6
Yarn dyeing—Klauder Weldon Giles type	30:1	10

The Klauder Weldon Giles machine, for equal liquor ratio, gives the lowest yield of Dieldrin. This may be due to the fact that the bath is being continually cooled by the hot skeins being exposed to the air. To main

tain temperature, fresh steam is required and this causes an increase in liquor volume. The best means for obtaining maximum yield is therefore to lower the liquor level to 20:1 and then add the diluted Dieldrin emulsion slowly, continuously, and evenly during 10 minutes at the end of the dye cycle and to run for 10 minutes more.

The same general procedure gives the greatest yield with any batch-dyeing operation. Analysis may reveal evenness of application.

The following example shows the results of normal feeding by hand, in absence of slow continuous even feed by spray pipe:

30:1 Liquor ratio
10 ozs Drewclad/100 lbs

n last five minutes of dye cycle		*% Dieldrin*
Stick	1 Right side	0.116
	1 Left side	0.051
	10 Right side	0.063
	10 Left side	0.050
	18 Right side	0.089
	18 Left side	0.073
	Avg	0.074

This is too uneven and a slower and more even feed is required.

In last 10 minutes of dye cycle

	% Dieldrin content
White	0.035
Henna	0.069
Royal blue	0.046
Green	0.119
Light blue	0.049
Turquoise	0.036
Avg	0.06

This indicates faulty, uneven method of application is being used on all lots.

The situation was corrected by adding the Drewclad from a 50-gallon container via a Venturi tube in the steam line, taking 10 minutes to evenly add the cold water emulsion. Ten ozs Drewclad added at the beginning of the dye cycle on a Klauder Weldon Giles machine yielded 0.02% Dieldrin on the finished yarn. The liquor ratio had increased from 20:1 to 40:1.

These examples also are given to illustrate the absolute necessity of a quality-control program.

Let us examine an application which has been running for several months.

Worsted suiting prepared from dyed top. Apply 0.1% Dieldrin in top dyeing. This will be reduced to 0.05% ± 0.01% after backwashing, scouring, fulling and scouring, carbonizing, neutralizing, finishing, etc. Eight lbs, four ozs of 20% Dieldrin concentrate are added to 1000 lbs top at the beginning of the dye cycle. The finally finished fabric is consistently in the 0.055% ± 0.005% Dieldrin range.

A careful costing (including labor, machine time, etc) shows that this application is far less expensive than applying four lbs per 1000 lbs in the washer, after fulling. The fastness of the Dieldrin on the finished fabric is much better when the Dieldrin is applied in top dyeing.

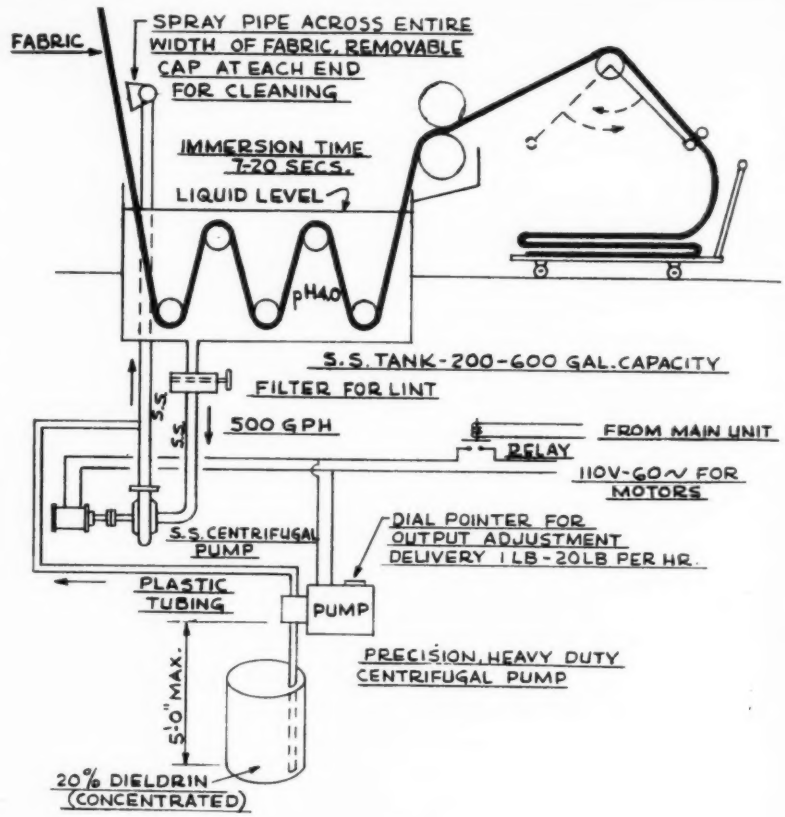

Figure 4

Continuous application of Drewclad to open-width woolen fabrics with pH 4.0 automatically controlled by Beckman pH Meter actuating feed of acetic acid

Lbs Drewclad per hr	Fabric speed, lbs per min
4	25
8	50
16	100

APPLICATION OF DIELDRIN BY CONTINUOUS METHODS —— In many cases of dyeing it does seem advisable to add the Dieldrin towards the end of the operation to obtain the greatest yield. A thorough examination on the effect of using non-ionic emulsifiers above their cloud point has not been made. There does not seem to be much loss of Dieldrin by steam distillation because, where liquor ratio is low, 80% plus exhaustion is obtained and the balance may be detected in the liquor by analysis. However, in the laboratory, at a vigorous boil at 212°F, at pH 2.0, it is possible to remove a large part of the Dieldrin from the wool by steam distillation. But analysis of Dieldrin content from well over 1000 dyekettles has failed to confirm any such condition in commercial application. However, the propensity to be removed by steam distillation is present and should be recognized, even though tests made by hanging woolen skeins in parts of the dyehouse accessible to dyehouse personnel have revealed no Dieldrin. Steam used in Hoffman presses, or in decating, etc, is not hot enough or of sufficient duration to have made any reduction in Dieldrin content. High-pressure autoclaves will remove some Dieldrin. In redyeing pieces already treated with Dieldrin, it will be found that some Dieldrin is boiled off to 50% (approx) and fresh Dieldrin must be added to the redye bath.

Open-Width, Woolen or Worsted Pieces, on Continuous Finishing Range. See Figure 4.

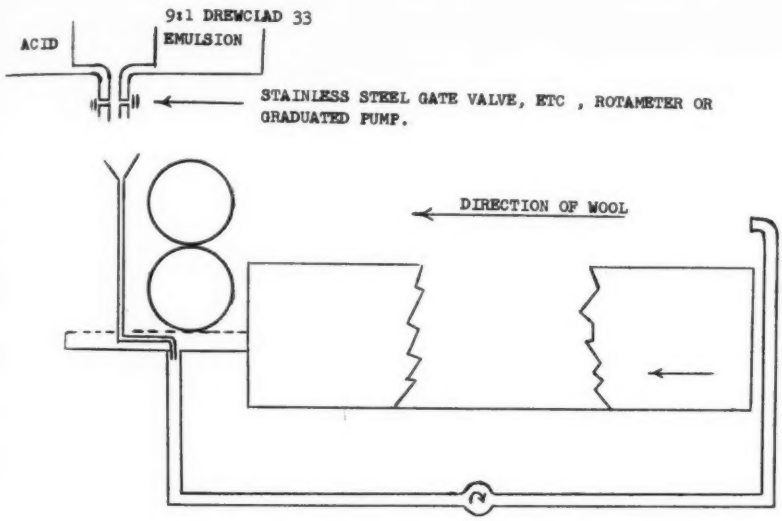

Figure 5

Drewclad application in last bowl of the raw wool scouring train. This process takes advantage of the very fast strike of Dieldrin which occurs as soon as the wool enters the bowl and which is not removed during the 90-second passage through the bowl.

20% Dieldrin concentrate feed per 100 lbs clean wool output	*Charge per 1000 gals (lbs)*	*Temp (°F)*	*pH*	*Purpose*
0.5 oz	—	140	7–8.0	To deposit 0.005% Dieldrin mothproof in storage and throughout manufacturing
6.0 oz	—	200	4.0	To deposit 0.05% Dieldrin for carpet wool dyeing with premetalized dyestuffs
1 lb	5	140	4.0 7.0	To deposit 0.1% Dieldrin to be subsequently raw stock dyed
1 lb	10	125	7.2	To deposit 0.1% Dieldrin
1 lb	1	125	2.0	To deposit 0.1% Dieldrin
1 lb	—	100	3.5% H_2SO_4	To deposit 0.1% Dieldrin

Raw Stock Wool Scouring Train. See Figure 5.

Raw Stock Continuous Dyeing in Fifth Bowl. See Figure 5.

In batch applications enough emulsifier is used with the Dieldrin to give stable emulsions at the boil at low pH conditions. In continuous application at long liquor ratio, at lower temperatures, less emulsifier is required to obtain a better yield of Dieldrin. More work needs to be done in this direction, although methods have been worked out to give even results by continuous application if the application is followed by carding or grilling.

Table VIII shows a typical application for a short run. The application probably has merit for felt manufacture, when the fabric is to be acid milled, or for top dyeing for knitting yarns, as these operations will set the Dieldrin.

Table IX gives two other typical applications in the fifth bowl of raw wool nonionic scouring train.

APPLICATION IN THE BACKWASHER — CHLORINATED TOP ———The application in the backwasher is a feasible operation that can be run continuously with even results. Chlorinated top picks up at least 30% less Dieldrin than unchlorinated top under identical conditions. When the application is made in the last bowl after a continuous chlorination process, the buildup of chlorinated protein and/or chlorinated wool wax or other matter carried over into the last bowl interferes with the determination of Dieldrin in the liquor. Chlorinated top and fabric after extraction for four hours with distilled water, and before mothproofing, when subjected to our analytical procedure (already described), shows ether-soluble chlorides present in amounts varying from 0.012%-0.034% as Dieldrin. Chlorinated wool should also be checked for evenness before Dieldrin application, and the fastness of the Dieldrin critically examined.

REGULAR (UNCHLORINATED) TOP———Continuous applications in backwashers have been made up to 40 hours. A typical operation which gives a satisfactory even distribution, and yields 0.07% on the top is as follows:

Application in last bowl of backwashing unit.

Temperature: 130° F, pH 4.0 (acetic).

Charge: 0.1 gpl Drewclad 33.

Feed: 12 ozs Drewclad 33 per 100 lbs wool. Prepare as 9:1 emulsion. Feed 55 ml per min for each 100 lbs top per hr.

Introduction of the emulsion via a rubber tube gives fairly even application, which is satisfactory after two gillings, but best results require cir-

TABLE IX

Carpet wool 140° F 90 seconds
Liquor at pH 4.0
Eight ozs Drewclad 33 per 100 lbs (continuous feed)

Time (mins)	*Percent Dieldrin on wool*	*Lbs Drewclad per 1000 gallons*
Start		1.04
5	0.059	
15	0.078	
30	0.061	
60	0.079	0.763
165	0.062	0.601
	Avg 0.069	

Pulled wool 140° F pH 5.0—pH 6.0 in fifth bowl
12 ozs Drewclad 33 per 100 lbs wool (continous feed)

Time (mins)	*Percent Dieldrin in wool*	*Lbs Drewclad per 1000 gallons*
Start		3.17
5	0.106	
15	0.072	
30	0.063	
60	0.076	
120	0.076	
180	0.067	0.840
240	0.094	
	Avg 0.079	

TABLE VIII

Conditions: 140° F, pH 7.2, fifth bowl after nonionic scouring of raw wool

Time (mins)	*% Dieldrin leaving dryer*	*Lbs Drewclad 33 per 1000 US gallons**	*% Dieldrin in top, samples taken one hr apart***
5	0.317	4.32	0.058
15	0.035	3.52	0.056
30	0.053	5.06	0.056
45	0.083	no sample	0.060
60	0.067	4.22	0.056
90	0.072	no sample	0.065
120	0.071	4.58	0.062
180	0.070	4.38	0.061
240	0.078	4.65	0.072
			0.066
			0.065

*Bath contained 6.0 lbs Drewclad 33 per 1000 US gallons before treatment.
**The eleven samples of top were taken as representative of the 6000-lb lot of top.

culation of all the liquor in the bowl with the Drewclad emulsion introduced just before the pump.

THE USE OF DIELDRIN ON NONWOVEN FELT———Piano hammer felt may be permanently mothproofed by the following technique, which is applicable also to other forms of mechanical felts:

The carded batt is laid on the table and evenly sprayed with eight oz of Drewclad in two gallons of water per 100 pounds of wool. The batts are steamed, hardened in the usual manner, then are acid fulled, rinsed, dried, buffed, pressed, etc. The attrition or loss in fulling is 50% so that 0.05% Dieldrin remains on the finished felt, which may then be cut into hammers as required.

If dyeing is required, the felt is fulled for 15 minutes, dyed in a rotary machine with acid colors and then acid fulled for the necessary three or four hours after dyeing. There is no loss in this dyeing. If more convenient, the wool may be mothproofed in raw wool scouring before carding. It should be observed that Dieldrin cannot be applied at the picker with wool oils, as the Dieldrin dissolves in the lubricant and is quickly removed by any rinse or scour.

EFFECT OF TEMPERATURE OF APPLICATION ON FASTNESS TO WASHING———Washing tests conducted on commercial production of Dieldrin-treated woolens produced by a variety of methods at various temperatures shows that, if 0.05% ± 0.01% Dieldrin is present on the wool, each application represents adequate mothproofness even after twenty handwashings, as shown by Table X.

0.05% ± 0.01% Dieldrin on the fabric may be considered as permanently mothproof when delivered to the end user for use in floor covering or for any type of apparel fabric or for mechanical felts, etc.

However, this does not mean that Dieldrin applied at any early stage of textile operation, such as in raw wool scouring, or in top backwashing, or even in package or skein dyeing, will be permanent and unaffected by such subsequent textile operations as scouring, drycleaning, fulling, dyeing, carbonizing, neutralizing, cross dyeing, speck dyeing, etc. In each case a quantitative analysis should be made to determine if there is any loss and what that loss amounts to. For example, a loss of 50% of the Dieldrin applied in top dyeing is due to the subsequent processes of worsted manufacture and worsted finishing. In spite of the loss, this process has the advantage of offering complete mothproofing in storage of all dyed top, spun yarn, etc. Furthermore, there is no labor cost of application or cost of additional machine time and labor such as would occur in batch application in the dolly washer.

TABLE X

Mothproofness after 20 washings—application at any temperature. Loss of Dieldrin content depending on temperature of application.

	Temp of application (°F)	Dieldrin content Before washing	Dieldrin content After 20 washing cycles***	Dieldrin loss (%)	Excrement* (mg)
Dolly washer	80	0.044%	0.015%	66	3.4
Dolly washer	120	0.068%	0.032%	53	2.3
Piece dye bath	205	0.058%	0.031%	46	2.7
Top dyeing**	205				
After piece finishing, fulling & scouring, etc		0.052%	0.040%	23	2.8

*ASTM D-582-54 Carpet Beetle Test. Untreated fabric —15.2 mg excrement.
**0.1% Dieldrin applied in top dyeing.
***One hand washing cycle = 95° F ± 5° F, five minutes, two rinses.

The best means of installing this mothproofing process in any plant is to determine these critical points:—liquor ratio, amount of steaming, means of obtaining even distribution of the Dieldrin—and then run analysis of samples taken from the various lots from various machines to prove even distribution and satisfactory Dieldrin content.

From the large number of analyses we have performed on Drewclad-treated fabric, we have been able to derive information relative to the statistical distribution of these data.

We know that Drewclad application lends itself to quality-control techniques, and we have shown that, for all types of applications studied, the data is normally distributed and is a controlled system.

Liquor ratios for each separate dyeing machine should be checked before the dye cycle begins and when it ends. The same size machines in the same dyehouse may end the dyeing cycle with a different liquor ratio. This is due to variations in carryover of wet steam caused by changing demands on the boiler throughout the day, or lack of sufficient insulation on steam lines reaching individual kettles by circuitous routes. The range of specifications of required Dieldrin content of 0.05% ± 0.01% usually will encompass such variations in liquor ratio, but they must be checked and understood. Finer wools and more loosely woven fabrics will pick up more Dieldrin. As a corollary to this, more Dieldrin and surface are exposed in washing. Here again, the limits of 0.04-0.06% will usually be sufficient to encompass differences due to these reasons, but caution is required.

In cases of doubt about adequate fixation, the mothproofing test should be run after 20 washings and 25 drycleanings. Every care must be taken to know exactly, by quantitative analysis, what is taking place at each operation.

Experience with a great number of applications definitely proves that the wool industry has an interesting possibility of enhancing the intrinsic value of the fiber. The methods of application are simple, the principles are clearly understood by those concerned with their application, but they are not foolproof and require just as much care as any other dyeing or finishing operation.

The Federal Trade Commission in the United States and an equivalent body in Canada have the right to seize and hold merchandise which is advertised as meeting these specifications but which fails to do so.

An appeal is made to the industry not to countenance any shortcuts but to insist on a tight quality-control program to be sure that 0.05% ± 0.01% is present on every pound of wool as delivered to the end user. The result will be that a confidence will be reborn for wool and the benefits of this American invention and Australian development will accrue to everyone concerned.

ACCEPTANCE, USE AND SAFETY IN HANDLING THE DIELDRIN PROCESS OF MOTHPROOFING IN THE UNITED STATES AND CANADA———The enthusiasm with which this process is being taken up in the United States is reflected in the following figures for wool mothproofed by the methods outlined in this paper.

	Rate Per Annum in Pounds
August 1958	100,000,000
September 1958	125,000,000
October 1958	150,000,000

A large part of this poundage covers wool used for floor covering, but the amount used for apparel wools is significant and the interest is growing at a rapid rate. The process is not being merchandised as a sales gimmick but rather as a means of improving the intrinsic value of the

wool. Surveys (6) have revealed that 90% of American women would prefer to buy mothproofed wool. Although the title of this paper includes the term "durable mothproofing," the phrase "permanent mothproofing" may now be used in the United States to describe this process, with the rigid proviso that the wool must contain $0.05 \pm 0.01\%$ Dieldrin.

A careful scrutiny of reports from the users of Dieldrin in textile and other manufacturing plants across the United States and Canada reveals excellent acceptance of this new product and process. One might comment that Dieldrin is not a skin sensitizer. Many millions of pounds of Dieldrin have been manufactured for agriculture and other uses and applied and handled by thousands of persons in the United States and Canada with trouble-free results. In the United States the product has been used for one year on socks, blankets, suitings, sweaters and carpets.

The trouble-free handling and application of this material to date appears to confirm the confidence of Shell Chemical Corp and the Research Department of E F Drew & Co, Inc, that Dieldrin is a safe and satisfactory means of mothproofing wool.

It should be noted that the average cost of this treatment is approximately ½ cent per pound of wool, which includes all costs of routine chemical analysis to see that 0.05% Dieldrin is deposited on the fiber.

CONCLUSION

Dieldrin is an efficient and inexpensive mothproofing agent. It can be applied at almost every stage of wet finishing or dyeing.

Higher temperatures of application give improved durability, but application at low temperatures give adequate fastness.

When applied before wet finishing, allowance must be made for attrition or for some loss of Dieldrin content in those operations.

A satisfactory but difficult and long method of analysis is available, a shorter one would be welcome, but analysis of Dieldrin content is essential to deliver the end product with acceptable amounts of Dieldrin present.

The evenness of application often depends on initial even mechanical application, and yield is affected by emulsifying system, liquor ratio, temperature, pH, and time in that order; therefore, like any other chemical or like a dyestuff, it must be applied with no compromise on care or vigilance.

The product is safe and presents no undue hazard in use or application. The chemical cost is very low and labor cost is avoided in many cases because the application of Dieldrin becomes a part of the dyeing or finishing operation. Therefore, with such low costs, each part of the wool industry can protect the whole by insisting on quality application. Improved yields and improved methods of application will be born of experience.

ACKNOWLEDGMENT

The author is pleased to acknowledge the permission of E F Drew & Co, Inc to publish this paper.

The assistance of coworkers at Boonton, NJ, is recognized, particularly that of T E Neesby for development of the analytical procedure and E S Segessemann, who is responsible for the emulsion systems in use, Francis Wooton, Jeff Kraus and Gerry Weiss for textile lab work.

Outside the Drew organization, we owe a debt to the technical personnel of the industry for their cooperation and critical advice. To Shell Chemical Corp, particularly A Williams, for guidance in the insecticide field and to M J Reider of M J Reider Associates, Reading, Pa, who has carried out a large part of the routine analysis required for daily control, and who has been available for consulting services.

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(2) Mitchell, L E, and Williams, A, paper delivered at April 10, 1958 meeting of American Chemical Society at San Francisco, Calif.

(3) O'Donnell, A E, Johnson, H W, and Weiss, F T, *Ag Food Chem* **3**, 757 (1955).

(4) Mitchell, L C, and Patterson, W I, *J Assoc Official Agr Chemists* **36**, 533 (1953).

(5) Neesby, T E—Present address: Schiefflein Co, New York, NY.

(6) Marketing Research Report No. 153, USDA.

FUTURE PAPERS

to Appear in the Proceedings

THE following list is comprised of papers submitted to date for publication in future issues of the *Proceedings*. Authors and Technical Program Chairmen are requested to examine this list and call our attention to any omissions.

Papers Presented at the 1958 Convention

"Dyeing of Acetate Blends and Arnel Triacetate Blends"—Victor S Salvin, Celanese Corp of America

"Some Observations Regarding the Chlorine Retention of Fabrics Treated with Dimethylol Ethyleneurea"—A R Smith, BIP Chemicals Ltd

"Evaluating the Effectivenss of Fluorescent Whiteners and Oxidizing Bleaches on Cotton"— M-S Furry, P L Bensing, J L Kirkley, R K Taube, N D Poole, and E S Ross, Clothing and Housing Research Div, USDA

"Evaluating of the Celanese Wrinkle Tester"—Ernest R Kaswell, Fabric Research Laboratories, Inc

"Optical Wrinklemeter"—Richard S Hunter and Clyde A Lofland, Hunter Associates Laboratory, Inc

Papers Presented before Local Sections

"Dyeing and Finishing Blends of Dacron Polyester Fibers and Cellulose Fibers"—C W Holweger Jr, J J Iannarone Jr and R J Thomas, E I duPont de Nemours & Co, Inc

"Reactive Dyestuffs" — Ernest L Caswell, Ciba Co Inc

"Acetate—A Basic Fiber for Nonwovens"—J L Barach and H W Coates, Celanese Corp of America

"Polymers as Related to Fabric Processing" — D Donald Gagliardi, Gagliardi Research Corp; Victor S Frank, Dewey & Almy Chemical Co; Lloyd H Perry, UBS Chemical Co; and Herman Mark, Polymer Research Inst

"Decorative Fabrics from Fibrous Materials"—Frank J Lachut, Owens-Corning Fiberglas Corp

"A Mild Cure Catalyst"—James B Irvine, Quaker Chemical Products Corp

ACTIVITIES OF THE LOCAL SECTIONS

Piedmont

PIEDMONT SECTION will hold its Spring Meeting April 10-11 at the Hotel Robert E Lee, Winston-Salem, NC.

Members and guests are invited to the Research Committee meeting, which will be held at 9 am on April 11. V S Salvin, Celanese Corp of America, will report for the Subcommittee on Mechanism of Carrier Dyeing and R L Wayland Jr will report for the Subcommittee on Mechanism of Chlorine Retention of Resin-Treated Fabrics.

The General Research Committee will meet in the State Room at 10 am.

The Officers' Luncheon at 12:30 pm in the Winston Room will be followed by the Technical Session in the State Room.

Speakers at the Technical Session will be Robert Turner, DuPont Co, on the subject "The Uses of Orlon in Knit Goods", and Dr Salvin on the subject "Relation of Dye Structure to Properties of Disperse Dyes".

The usual Social Hour will begin at 5:30 in the State and Salem Rooms.

The evening banquet will feature as speaker George L Simpson, director, Governor's Research Triangle, Chapel Hill, NC. Dr Simpson will be introduced by Fred Wedler, president, Burlington Finishing Co.

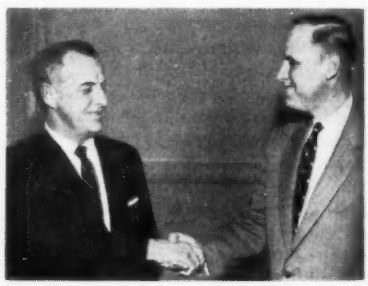
Rhode Island

(Photos by Kenneth C Everett)

Karl E Schaeffer (left), speaker at the Rhode Island Section's Dec 4, 1958 meeting, chats with J William Timperley, National Councilor. Dr Schaeffer, director of the Physiology Dept, Navy Medical Research, New London (Conn) Submarine Base, spoke on the subject "Pertinent Medical Problems in Submarine Medicine."

Ernest P Sommer, vice president, Carbic Color and Chemical Co, Inc, speaker at the Rhode Island Section's January 30, 1959 meeting. Dr Sommer's talk was entitled "Remazol Colors—A Chemically New System of Fiber-Reactive Dyes."

James Falcon, chairman, Rhode Island Section Dining Committee, sells ticket to Francis H Casey, National Councilor, for Jan 30 meeting.



Thorwald Larson (left), retiring chairman, Rhode Island Section, greets Robert H Phillips, 1959 chairman, at Jan 30 meeting.

Southeastern

SOUTHEASTERN SECTION met February 21 at the Ida Cason Callaway Gardens, Pine Mountain, Ga, with approximately 175 members and guests in attendance. Plans for the meeting were handled by Ben S Daniel, Lanett Bleachery & Dye Works, Lanett, Ala. Chairman Robert B Hallowell, Coats & Clark, Inc, presided.

Featured speaker at the meeting was James B Irvine, director, textile process development, Quaker Chemical Products Corp, Conshohocken, Pa, whose subject was "A Mild Cure Catalyst".

The ladies program included a card party, and some of the men enjoyed an informal golf tournament.

At the evening banquet, the film "Textile Chemistry—Field with a Future" was shown. (See page 100 of the February 9 issue).

Metropolitan

METROPOLITAN SECTION held its first meeting of 1959 on February 27 at Kohler's Swiss Chalet, Rochelle Park, NJ, with Chairman John A Komninos, Waldrich Co, presiding. The attendance was 275.

The technical meeting was in the form of a symposium, the theme of which was "Application of Resins to Textiles". D Donald Gagliardi, Gagliardi Research Corp, served as moderator of a panel which included Albert C Nuessle, Rohm & Haas Co, who spoke on "Chemical Finishing Agents Required for Successful Resin Application"; Theodore F Cooke, American Cyanamid Co, who discussed "Chemistry of Resins"; and Charles Minoff, formerly of Texstyle Co, who spoke on "Practical Experience in Application".

In attendance at the meeting were Weldon G Helmus, Fair Lawn Finishing Co, AATCC president; Harold W Stiegler, AATCC's director of research; and a delegation from the Delaware Valley Section headed by Thomas H Hart.

Niagara Frontier

A JOINT MEETING of the Niagara Frontier Section, AATCC; the Ontario Section, CATCC; and the Western Div, Textile Society will be held Saturday afternoon, April 4 at McMaster Univ, Hamilton, Ont.

The meeting will be in the form of a symposium on fibers with the following panelists participating: Walter Stump, Chemstrand Corp, for Acrilan; A J Straw, Canadian Industries Ltd, for terylene; Armond P Zinnato, DuPont Co of Canada Ltd, for nylon; and Glen Woodside, DuPont Co of Canada Ltd, for Orlon.

John Mansfield will serve as chairman of the symposium.

Membership Applications

SENIOR

Zach S Cowan——Salesman, E I duPont de Nemours and Co, Inc, Grasselli Chemicals Dept, Atlanta, Ga. Sponsors: J T Hall, H V Ackerman. (S).

Margaret T Goldsmith——Tex and clothing lab, Agricultural Research Service, U S Dept of Agr, Washington, DC. Sponsors: V I McLendon, M S Furry. (W).

Lawrence Hart——Research engr, American Enka Corp, Enka NC. Sponsors: V B Wright Jr, L R Graybeal. (P).

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William E Mainella——Textile chemist and colorist, National Aniline Div, Allied Chem Corp, New York, NY. Sponsors: W A Holst, P L Oertel. (M).

Joseph J Murphy——Salesman, Laurel Soap Mfg Co, Philadelphia, Pa. Sponsors: W H Bertolet Jr, W H Bertolet III. (M).

Katsuji Nagatsu——Research director, Ashi Tsusho Corp, Tokyo, Japan. Sponsors: H W Stiegler, H E Glidden.

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JUNIOR

Clifton B Rodes——Research tech, Collins and Aikman Corp Lab, Albemarle, NC. Sponsors: J Bauer, W D Hathcock. (P).

ASSOCIATE

Lance A Craig——Dyehouse supt, Spencer Mfg Co, Spencer, W Va. (W).

Robert G Short——Tech rep, Union Carbide Chem Co Div, Union Carbide Corp, Charlotte, NC. (P).

STUDENT

B J DeRing——Student, Alabama Polytechnic Inst, Auburn, Ala. Sponsor: J H Cox. (API).

TRANSFER TO SENIOR

Robert M Dameron——Tech rep, Wica Chemicals Inc, Charlotte, NC. (P).

Ersel O Jones——Finishing foreman, Collins and Aikman Corp, Cavel, NC. (P).

TRANSFER
(STUDENT TO JUNIOR)

Joseph H McCusker——Chief chemist, Research and Dev Div, Chandler Mfg Co, East Taunton, Mass. (RI).

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

59-3

Education: Long Beach High School; BS, N C State College; NYU Graduate School of Business.

Experience: Customer service laboratory; plant—quality control, supervision, laboratory.

Position desired: Dyer or assistant; plant chemist, technical service.

Location: 1st—New York Metropolitan area; 2nd—anywhere.

Age: 28; single; references.

OLNEY MEDAL AWARD CANDIDATES

THE Olney Medal Award Committee invites Senior members of AATCC to nominate candidates for the 1959 Olney Medal.

The medal is awarded for outstanding achievement in the field of textile chemistry, including the development of chemical agents or chemical processes used in the manufacture of textiles, or methods of their evaluation. Its purposes are to encourage and afford public recognition to such achievements and contributions and to be a testimonial to Dr Louis Atwell Olney in recognition of his life-time of devotion and multitudinous contributions to this field.

Nominations should set forth in detail all facts which qualify the candidate of consideration, with particular reference to published works and professional qualifications.

Previous winners of the Olney Medal are: Milton Harris, William H Cady, Edward R Schwarz, Harold M Chase, Charles A Seibert, George L Royer, Raymond W Jacoby, Werner von Bergen, Roland E Derby, William D Appel, Miles A Dahlen, Walter J Hamburger, P J Wood, and Henry E Millson.

The voting members of the committee on awards are: Paul L Meunier, *Chairman;* Edward W Lawrence, Milton Harris, James L Taylor, and President Weldon G Helmus, ex-officio.

Nominating letters and complete data should be in the hands of the committee by April 1, 1959. Please address to G P Paine, secretary, Olney Medal Committee, AATCC National Headquarters, Box 28, Lowell, Mass.

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Alabama Polytechnic Institute, Bradford Durfee College of Technology, Clemson College, Georgia Institute of Technology, Lowell Technological Institute, New Bedford Institute of Technology, North Carolina State College, Philadelphia Textile Institute, Rhode Island School of Design

MARCH MARCH
1959

Inter Alia — Inter Nos

P J WOOD

AULD LANG SYNE

The other day one of our good friends sent us (on loan) a copy of what looks like the first annual AATCC Year Book carrying the date of 1923.

The total membership of the organization was listed as 408 souls, comprising what was described as the Active Membership. There were also 94 so-called Junior Members; the class of Associates had not yet been instituted.

The amiable Winthrop C Durfee was treasurer, and how he could treasure! In the year 1922 he received 1885 dollars in dues. Lo! at the end of the year he showed a plus balance of $514.72 and all bills paid. O tempora, O mores mutantur, O the times and the customs, how they are changed!

William H Cady is the sole survivor of the roster of officers, he being one of two vice presidents, at the time, the others being president, the aforesaid treasurer and a secretary.

The Council consisted of these worthy men, six Councilors at large, of which Arthur Hirst, Walter Scott and Bill Moorhouse are still with us, and the chairmen of the four sections, of which there remain Ralph Culver and this scribe, all four ex-officio members of the Council.

This publication also reveals that the Association had Corporate Members, four of them. Geigy Co, Howes Publishing Co, Newport Chemical Works (long ago absorbed into the Du Pont organization), Nyanza Color and Chemical Co, all still Corporate Members of the Association. Old and faithful friends of many years, we salute you.

The mention of Walter Scott reminds us that we saw Raphael Rupp, his brother-in-law, at the last Council meeting of AATCC. He told us that Dr Scott is enjoying his stay in Italy, where he will remain for many moons; on his return we shall expect to see him consume spaghetti with the correct Italian accent, occasionally, no doubt, addressing his wife as "dolce pizza", which may have been the favorite appelation of Juliet as used by Romeo, this being our imaginary interpretation of the American "sweetiepie".

PHYSICS

"Quote", which we read regularly with pleasure and profit, and from which we occasionally quote, recounts some of the findings of a learned professor and electrical experimenter in the Feb 22 number. It seems the researcher was looking into the important matter of the noise made at cocktail parties.

Why this matter claimed our attention to the extent it did is probably due to the fact that we are in the ranks of the total abstainers, drinking, as we do, nothing stronger than English ginger beer, which, contrary to expectations contains ginger, but no beer. This being the case, we are not a frequent attender at such functions, which are usually devoid of anything as innocuous as English ginger beer.

The professor was able to reduce his scientific findings to a mathematical formula, which we just know we wouldn't understand. "Quote" gives a practical example: "If your living room is 15 by 15 feet and has high ceilings, you could accommodate 16 people at a nice, low decibel party. But if a seventeenth guest drops in, the neighbors are likely to call the cops".

The professor explains that the sudden change is not due to the fact that the party gets progressively louder. It changes "all-of-a-sudden" as Sarah Ellen used to say, or, as they say in nuclear physics it "goes critical".

Most of the few cocktail parties that we attended seemed to have "gone critical" long before we got there.

By way of conducting a blank test for comparison, we suggest that the professor run off an English ginger beer party and publish the results. We would like to see this report. We could be wrong.

WHAT EXACTLY IS AGE?

This was the question posed recently by one of the English science reviews, to which that witty serio-comic journal "Tit-Bits" (London) propounds this reply "A process in which a man loses his hair, his illusions, and what little patience he may have had".

What about teeth? It seems to us that long before a man has acquired the right to be referred to as venerable, he has also lost his teeth. And even if he still has them, by the time he is middle-aged, they are so old and bent that he soon gets into the habit of refraining from ordering those juicy, succulent but usually somewhat recalcitrant steaks that he was wont to eat in the days of his youth.

But while it is conventional to invest in a set of artificial teeth, which can be the cause of considerable confusion, as they sometimes clash gears at inopportune moments, it is less common to find people concealing the passage of the years by taking corrective measures against the misfortune of baldness, if it is a misfortune, which is debatable.

A toothless man, on occasion, can be a ludicrous sight, but a bald man, very often has a distinct air of dignity and creates an impression of wisdom.

What do the old pundits say on the subject? Take Cicero, for instance, in his well-known treatise "De Senectute" (Concerning Old Age). Here it is, Latin scholars, "Mature fieri senem, si diu velis esse senex" which, loosely translated, reads "You must become an old man in good time if you wish to be an old man long". Then again, that usually happy philosopher, Oliver Wendell Holmes, remarked to Julia Ward Howe, on the occasion of her seventieth birthday "To be seventy years young is sometimes far more cheerful and hopeful than to be forty years old".

The mention of "Tit-Bits" reminds us of another English publication, "Answers", which ran a competition, the prize, a thousand pounds (sterling), at that time equivalent to $5000, for the best answer to the question, "Is life worth living?". The winning answer, "It depends on the liver".

COMMON SENSE

In the January number of "Man-Made Textiles", an English magazine edited by our friend Tom H Parker, and we mean edited, there is a short article relating to Wash & Wear, which the English seem to call "Drip-dry". It is written by A R Urquhart, assistant director of the British Cotton Industry Research Association, whom some of you may have met when he visited this country a couple of years ago, together with John Boulton, director of Courtaulds dyehouse and labs at Droylesden, Manchester.

In the report, which is a condensation of a lecture delivered before a joint session of the Midland Section of The Textile Institute and the Coventry Textile Society, Dr Urquhart emphasizes the importance of fabric construction, a phase of this problem which does appear to deserve more attention than has generally been vouchsafed to it, up to the present.

Personally, we fail to see the necessity of wash & wear treatment for an evening dress shirt with a stiff or pleated bosom. Everybody who wears such a shirt two, three or four nights in a row, usually possesses a positive plethora of shirts of this type and must, of necessity, have them laundered after each wearing. In fact they are so liable to suffer sufficient creasing, even in just putting them on, that they could be successful candidates for the laundry bag, without being worn at all. Besides, these shirts are mostly worn under conditions that promote profuse perspiration. They just cry for washing after each wearing, deodorants notwithstanding, or ruin for ever the reputation of the wearer.

The learned doctor concludes with these wise words "My general conclusion with regard to the degradation that occurs during the application of the finish is that although it must reduce wear life to some extent; the drip-dry shirt laundered at home as it was designed to be laundered, should last at least as long as the non-drip-dry shirt that is regularly submitted to the average laundry".

As Elmer sapiently, even though somewhat uncouthly, remarks, "You can't eat your cake and have it. You never get nothing for nothing."

WASH & WEAR

It's hard to get away from this timely subject and much and devious writing has been done concerning this matter. If someone wished to compile a complete bibliography on Wash & Wear, we really believe this could be done by collating all the items that have appeared in that well-edited journal, the Digest for Soap & Detergent Executives, published by the Association of American Soap & Glycerine Producers, Inc.

If anything has escaped the eagle eye of the painstaking Anne Fallon, who pounced on these items in all the journals of the civilized world, it must be something of small moment.-Q.E.F.

News of the Trade

Berkshire Color Opens Southern Branch Office

Berkshire Color & Chemical Co has opened a new Southern Branch Office with complete warehouse facilities and laboratories at 3209 Cullman Avenue, Charlotte, NC.

Thomas J Ratajczak will be Southern District manager. The newly equipped laboratories reportedly will enable Berkshire to handle all service work required by its customers in the southern area. Charles P Van Name, who for a number of years was with Burlington Industries, has been named technical director.

All Berkshire customers now being serviced through Valco, Inc of Thomasville, NC (formerly southern representative for Berkshire) will continue to be serviced through that firm until July 1, at which time Valco, Inc will terminate all sales in the dyestuff field.

Cheminform Institute Broadens Facilities

The Cheminform Institute, Coliseum Tower, New York, NY, has broadened its facilities as a source of chemical information.

In addition to information on composition, use and source of supply of chemicals and compositions containing chemicals made in the USA, it reportedly can now furnish such information for all European countries including those behind the "Iron Curtain," Latin America, Australia and Japan.

RCI Initiates Methanol Shipments

Large-quantity tanker and barge shipments of methanol to northern market areas recently have been initiated by Reichhold Chemicals, Inc.

First shipment to the northeast consisted of 670,000 gallons loaded aboard tanker at Mobile, Ala, site of RCI's new deep water terminal, and discharged at Carteret, NJ. The Chicago area received its first such shipment via 360,000-gallon capacity barge from Pensacola, Fla.

Importance of these initial shipments is underscored by the fact that an anticipated 1,500,000 gallons will pass through the Chicago facilities per year. Shipments will be made from these points via tank trucks or tank cars.

GRC Textiles Program Announced

The 1959 Gordon Research Conference in Textiles will be held July 13-17 at Colby Jr College, New London, NH, with Leonard Smith serving as chairman, and Fred Fortess as vice chairman.

The program of subjects and speakers follows:

July 13—"New Findings in Wool Structure, Stability and Modification", Harold P Lundgren; "The Relationship of Polymer Constitution and Fiber Fine Structure to Fiber Physical Properties", Sheldon Sprague.

July 14—"Phenomena Associated with Crosslinking of Cotton Cellulose", V W Tripp and Fred Perkerson; "Chemical Control of Crease Recovery and Wash-Wear Effects on Cellulose Fibers", Richard Steele and John L Gardon.

July 15—"Interfacial Polycondensation," E L Wittbecker; "Interfacial Spinning," E E Magat; "Kodel Polyester Fibers," E V Martin.

July 16—"The Measurement of Mechanical Properties and Prediction of Fabric Performance," Joel Lindberg; "On the Mechanics of Nonwovens," Dewitt R Petterson and Stanley Backer.

July 17—"Stress-Strain Relations in Yarns Subjected to High-Speed Impact," Jack C Smith.

Attendance at the Conference is by application. Those interested in attending are advised to send applications to the director, W George Parks, by May 13.

Application forms and full information may be obtained by writing to Dr Parks at the Department of Chemistry, Univ of Rhode Island, Kingston, RI.

A fixed fee of $100 covers registration, room, meals and gratuities.

Benzaldehyde, Technical, Price Changes Announced by Heyden Newport

Price increases affecting benzaldehyde, technical—a chemical used in the synthesis of dyestuffs and other organic chemicals—were announced March 10 by Heyden Chemical Division of Heyden Newport Chemical Corp.

Effective April 1, the price of benzaldehyde, technical in car and truckload lots will be 47¢ a pound, and in less than carload lots 48¢ a pound. The prices formerly were 43¢ and 44¢ respectively. Tank-truck lots will be increased correspondingly to 46¢ a pound. The present price schedule of benzaldehyde, N F is not affected by these changes.

The price changes were brought about by rising costs, the firm states.

Apex Contracts for Added Space

Apex Chemical Co Inc, Elizabethport, NJ, has contracted for the erection of an additional 10,000 square feet of storage and shipping space to handle increased volume of shipments. The new building will be a one-story concrete and steel structure.

Venango to Handle Mezzera TMB Tube Dyeing Machine in US

Venango Engineering Co, Inc, Philadelphia, Pa, reportedly has acquired exclusive sales rights in the United States for the Mezzera Type TMB Tube Dyeing Machine for dyeing yarn in hank forms. The machines are built in standard types: 2, 4, 8, 12, 20 tubes and laboratory type. The Mezzera tube dyeing machine employs the principle of big liquor flow with a minimum movement of the yarn. During the dyeing a hank moving rod rotates in both directions round the perforated tubes at previously fixed intervals.

All machines are equipped with closing hoods which have inspection windows, which are designed to save space, prevent the loss of fumes and heat, and afford fuel economy.

These machines are employed for dyeing viscose, Bemberg, acetate, natural silk, cotton, and synthetic fibers. Yarns in hanks, even of the most delicate types, reportedly may be handled. It is also claimed that highest winding output is due to very delicate treatment of the hanks and to the elimination of any entanglement of the yarn.

Drew Textile Research Lab Completed

A new 10,000 square foot textile research laboratory for E F Drew & Co, has been completed at Boonton, NJ, by the Wigton-Abbott Corp, engineers and constructors of Plainfield, NJ.

The unit will be used to study development of new products for the textile industry.

Diphenyl Brilliant Flavine 7GFF

A new "super bright" yellow dyestuff, particularly recommended by its manufacturer for cellulosic fibers, is now being offered by the Dyestuff Division of Geigy Chemical Corp.

The new direct dyestuff, Diphenyl Brilliant Flavine 7GFF, has a distinct fluorescent cast and greater brilliance than any other direct yellow dyestuff on the market, it is claimed.

Geigy's new yellow reportedly has a lightfastness rating of 3 on both rayon and cotton. Similar ratings are said to be obtained for washing at 120°F.

Geigy states that, while the new yellow may be too bright for use as a straight yellow, except as a novelty color, its widest field of application will be in combinations with Solophenyl Turquoise Blue GRL, Turquoise Blue GL and Blue 8GL to produce greens with a brightness heretofore unattainable in the cellulosic field.

Other properties which Geigy attributes to Diphenyl Brilliant Flavine 7GFF are:

Suitability for open jig application, since maximum exhaustion can be obtained at 180°F; excellent migration and therefore good level dyeing; good solubility, with a 5 rating; and improved lightfastness with certain aftertreatments—lightfastness gaining up to 1½ points with the use of urea-formaldehyde and melamine-formaldehyde crease resins.

Tinofix LW aftertreatment reportedly increases fastness to water and, when added to resin finish, provides good fastness to washing.

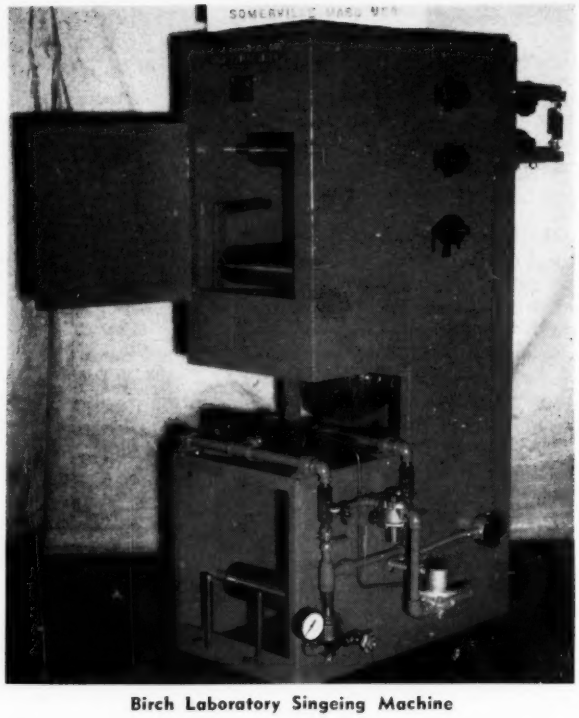
Geigy also recommends the new yellow for screen and machine printing.

Copies of Bulletin 113 G covering fastness properties, dyeing procedures and characteristics of Diphenyl Brilliant Flavine 7GFF, may be obtained by writing to Geigy Dyestuffs, PO Box 430, Yonkers, NY.

Two-Burner Vertical Singeing Machine

Birch Brothers, Inc, Somerville, Mass, has introduced a two-burner vertical singeing machine for laboratory use.

A small, compact unit designed for table top mounting, the machine is equipped with lead-in guide bars, ball-bearing guide rolls, two open-flame ribbon burners, complete gas mixing and ignition equipment, a pair of steel spark extinguishing rolls, a pair of driven ash brushes, a pair of driven rubber-covered draw rolls, and a built-in ¾ hp motor drive.



Birch Laboratory Singeing Machine

It reportedly is fully wired and piped, requiring only connections to electricity, gas, compressed air (a blower is not required), and an exhaust duct. The unit shown has a 12" operating face.

Bancare Trademark Assigned to Bancroft's Newest Fabric

The trademark "Bancare" has been assigned to the wide range of fabrics produced by Joseph Bancroft & Sons Co's new nonresinous process wherein cellulosic cloth allegedly is transformed into a new fabric with greatly improved easy-care properties.

The development of this newest member of the Everglaze family of fabrics was revealed recently as Research Project "X." (See page 63 of the March 9 issue).

W R MacIntyre, Bancroft president, has stated that Bancare fabrics possess many unique wash-and-wear characteristics, the most important of which are a markedly improved compatibility for resin treatment, improved wet and dry wrinkle recovery, and the "ability to iron themselves" as they wash and dry.

Because of trade interest, the Bancroft Co is planning a licensing program for both finishers and converters.

Facilities are being enlarged at the Bancroft plant and full production is expected by early summer.

Washfast Bonded Royal

Bonded Royal, a brilliant washfast blue shade which reportedly has never been produced hitherto except by the vat-color process of dyeing, was announced last month by Franklin Process Co, division of Indian Head Mills, Inc.

Termed "a new discovery in color" due to modern chemical research, Bonded Royal is said to make it possible to include a brilliant shade of Royal in the color range at a cost below that of a similar vat color. In most cases, according to Franklin Process, Bonded Royal can be shaded to match samples.

While it is not fast to bleaching, Bonded Royal is claimed to be washfast (140° F) and lightfast (80 hours). Franklin Process suggests use of Bonded Royal for fabrics that are not subject to bleaching. Samples are available on request from any Franklin Process plant or office.

Emkatex NTA

Emkatex NTA, a chemical formulation designed to minimize tendering of fabrics during the removal of crease-resistant resins with acid has been developed by Emkay Chemical Co, Elizabeth, NJ.

Emkatex NTA is applied to the goods as a protective colloid just before the addition of muriatic acid. The product reportedly also acts as a lubricant, keeping the goods soft and pliable during this resin removal, helping to keep the goods in good condition for redyeing and refinishing.

Emkatex NTA is available in 450-pound drums.

#66 and #68 Germicide

To combat offensive odors due to the growth of bacteria and microflora organisms in textile-processing liquors and slurries, the Chemical Products Division of American Charcoal Co, 201 South St, Detroit 17, Mich, has developed a new type of solution germicide.

Research into the problem of bacterial growth in textile-processing liquids reportedly indicates that these organisms soon develop an immunity when subjected to repeated use of one form of germicide. American Charcoal advocates the use of two different types of germicides in an alternating sequence. Thus, by switching from one to the other, resistant strains of bacteria cannot have a chance to develop.

The result of this research is the development of American Charcoal's #66 and #68 Germicide, which, it is claimed, provides continuously effective control of liquor and slurry rancidity and odor under all plant conditions.

Highly concentrated, and with a highly alkaline pH, Germicide #66 and #68 may be added in small amounts directly into the processing solution. In this way, the germicide is efficiently distributed to all parts of the processing solution and related machinery where odor-producing organisms become established.

These colonies are usually destroyed within one hour after the germicide has been added, American Charcoal chemists report.

In addition, it is pointed out that important savings are realized because cleaning and sanitizing of tanks, sumps and equipment is accomplished by the processing solution itself—steam-cleaning and other costly procedures are eliminated.

One-third to one-half pint of American Charcoal's Germicide #66 or #68 is said to be sufficient to sanitize and deodorize 50 gallons of solution.

Dowfax 2A1

Development of an anionic surfactant "with unusual solubility and stability properties for use in industrial and household applications" is announced by the Dow Chemical Company. The new product, Dowfax 2A1, is a sulfonated alkyl-diphenyl oxide.

The diphenyl oxide grouping is said to be unique in that it results in a very stable material. It is reportedly very soluble in water, and at room temperature, 50 percent solutions can be prepared. At 77° F, it is reported to be soluble and stable at 0.1 percent concentration in nearly all 20 percent aqueous solutions of inorganic compounds. In some systems, as much as 20 percent or more Dowfax 2A1 dissolves to provide clear solutions, it is claimed.

Inorganic compounds with which good solubility and stability may be achieved are said to include: sodium hydroxide, hydrogen chloride, calcium chloride, sodium sulfate, sulfuric acid, phosphoric acid, sodium orthosilicate, tetrapotassium, pyrophosphate, sodium chloride, zinc chloride and nitric acid.

Dowfax 2A1 is also reported soluble in organic acid and organic salt solutions. In addition, it is said to be extremely soluble and stable in all strong electrolytes that have been checked, covering the entire pH range and at temperatures varying from freezing to boiling.

According to Dow, this new surface-active agent possesses extremely good surfactant properties in all of these systems. It is further claimed that it has good properties as a wetting, dispersing, emulsifying agent and as a detergent.

It also is said to possess outstanding capabilities as a hydrotrope or coupling agent for normally insoluble or slightly soluble organic and inorganic compounds.

In the textile industry, Dowfax 2A1 may be used as a surfactant in kier boiling of cotton, as a wetting agent and solubilizing agent in mercerization of cotton, in the carbonization of wool and for pasting and dispersing difficultly soluble dyes.

It is now available in commercial quantities for the first time as a light-colored, free-flowing powder and as a concentrated solution.

A bulletin, "Dowfax 2A1," is available from Technical Service and Development, The Dow Chemical Company, Midland, Mich.

APO

An organic phosphorus compound called APO may hold an answer to improved "wash-and-wear" cotton garments, according to a recent announcement by the U S Dept of Agriculture.

Investigations by the Department's Agricultural Research Service reportedly show that APO solves one of the major problems associated with some of the other wash-wear finish treatments, ie, the tendency, particularly in white shirts and blouses, toward yellowing or other discoloration when treated with chlorine bleaches. APO finish is said to be highly resistant to damage from these bleaches, which are commonly used in both hand and commercial laundering.

APO also is said to give cotton outstanding crease retention and wrinkle resistance. Changes in the hand of the fabric are slight, and the treatment is far more durable than other known wash-wear finishes, it is claimed.

In addition, APO treatment is said to increase flame resistance of the fabric to some extent, depending on the amount added, and on the construction and weight of the fabric. However, small amounts reportedly will change the burning characteristics of the fabric, and afford some protection to the wearer.

Currently, the cost of APO (most of the chemical used in the United States is imported) is the major obstacle holding back commercial adoption of this new treatment, USDA says. Limited production of APO by two U S firms indicates it can be produced at lower cost in this country. Other U S companies have expressed interest in producing APO.

Scientists at the ARS Southern Utilization Research and Development Division in New Orleans did their first work with APO—chemically, tris (1-aziridinyl) phosphine oxide—while seeking ways to make cotton flame resistant.

During the course of their experiments, chemists G L Drake Jr and J D Guthrie noted that treated cotton samples had excellent wrinkle resistance. Further checking reportedly showed APO-treated cottons had better crease retention and wrinkle resistance than most of the present commercial wash-wear cotton fabrics.

The finish is applied by dipping the cotton fabric into a water solution of APO and removing the excess by passing the fabric between pressure rollers. The cloth is dried at temperatures between 175° F and 195° F for four or more minutes depending on its weight, and then cured at about 285° F for four minutes.

Beta-S

Beta-S, a new liquid dicarboxylic anhydride, is being introduced in development quantities by Heyden Newport Chemical Corp.

Testing reportedly shows the product to be particularly useful in curing epoxy resins. Beta-S, dimethyl substituted butenyl tetrahydro phthalic anhydride, has a combination of double bond and anhydride functionality indicating potential as an intermediate for preparing surfactants and dyes, among other possibilities.

Physical testing reportedly shows epoxy systems cured with the anhydride to possess high compressive and flexural strengths, low power factor characteristics and low shrinkage.

The chemistry of Beta-S suggests its use as a valuable intermediate. Readily reactive, the product will undergo hydrolysis, esterification, amidation, imide formulation, reduction, aromatization and oxidation, it is claimed.

One-pound samples and further information on Beta-S are available from the Market Development Department, Heyden Newport Chemical Corp, 342 Madison Avenue, New York 17, New York.

Improved Color and Color-Difference Meter

A precise, digital-dial color and color-difference meter recently introduced by Hunter Associates Laboratory, Inc, McLean, Va, should prove useful in shading applications, especially where there is need to measure a color difference or to group bolts of cloth, already dyed, into lots of identical color. It reportedly employs tristimulus filters and vacuum phototubes which are thermostatted for maximum stability. It is claimed that the analog scales of the instrument have nearly the uniform visual spacing of the Munsell Color System:

1) L measures lightness and varies from 100 for perfect white to zero for black,
2) *a* measures redness when plus, gray when zero, and greenness when minus,
3) b measures yellowness when plus, gray when zero, and blueness when minus.

With a ceramic hitching-post color standard *close to the color of a product*, accurate color measurements of this product can be made, it is stated.

A new color-difference attachment gives components of color difference between sample and standard and then total color difference using an equation in which weighting factors may be adjusted to conform to visual grading practices for the product

HAL color and color-difference meter

under study. Noteworthy features of the new instrument, as cited by the manufacturer, are:

1) Digital dials which have separate plus and minus windows for the *a* and b scales,
2) Zero-centered *a* and b potentiometers which eliminate polarity switches,
3) Electrical rather than mechanical adjustments to standard,
4) Vacuum - tube galvanometer with rugged microammeter not disturbed by building vibration,
5) Uniform indication of direction of rotation for all dials and scale knobs.

A detailed description of the new apparatus appeared in the December, 1958 issue of the *Journal of the Optical Society of America.*

Amsco to Distribute Igepal CO and CA

Antara Chemicals, sales division of General Aniline & Film Corp, New York, has appointed Amsco Solvents & Chemicals Co, 4619 Reading Road, Cincinnati 29, Ohio, as distributors for Igepal CO and CA surfactants. They will provide truck delivery of drum and bulk quantities in Cincinnati, Dayton, Columbus, Springfield and the Southern Ohio area.

Bulk storage for Igepal CO-630 and Igepal CA-630 will be established at Cincinnati in the near future. In the meantime, bulk quantities can be supplied from Detroit in tank trucks of up to 6,000-gallon capacity. Compartmented trucks are also available, permitting mixed bulk shipments of Igepal or of Igepal and other liquid products supplied by Amsco. Service facilities are available to accommodate customers who desire the blending of two or more surfactants.

Customers may make their own bulk or drum pick-up or designate other carriers, if they wish.

Hysorb

Hysorb, a new finish which was introduced by Scholler Brothers, Inc, Philadelphia, Pa, last fall, continues to be acclaimed for its ability to produce increased wearing comfort and desirability of fabrics made of synthetic fibers.

The finish is said to render synthetic fabrics "absorbent" through the effect of a wicking action when moisture makes contact with the fabric surface resulting in instantaneous dissipation of the moisture. The finish had been under development by the company for several years and, in anticipation of its earlier perfection, the company had registered the "Hysorb" name and trade mark in 1954.

Said to be readily applied in conventional equipment and by recognized methods, Hysorb affinity to almost all man-made fibers reportedly makes application comparatively simple. The finish is claimed to be equally applicable to natural and synthetic-fiber blends.

In addition to the absorbency advantages that it gives to fabrics, the new finish reportedly provides an exceptionally fine hand. Because of the added ability to take on moisture, Hysorb-finished fabrics of man-made fibers are said to take on a new, natural feel, a new-found skin compatibility that adds wearing comfort to a marked degree. It is stated that fabric that is normally moisture-resistant now "breathes," permitting the absorption of perspiration as well as aiding in the evaporation of skin moisture.

Durability of the new finish is largely dependent upon the type of washing agents used; milder-type detergents are recommended. For all garments that are typical of against-the-skin wear, such as lingerie, underwear, shirts, blouses, girdles, brassieres, etc, hand washing or machine washing with detergents will assure acceptable absorbency retention, the company declares. It has been further stated that examination of Hysorb-treated fabric, after repeated wash-and-dry cycles, reveals no harshening of hand and that the pleasing surface of the original finish is retained.

The use of the Hysorb label requires a simple license for quality control and trademark protection. No royalties or license costs are involved in the use of the trademark or the finish.

TECHNICAL LITERATURE

(Literature is available from sources shown in italics)

AGILON STRETCH YARN—*$1.00; Deering Milliken Research Corp, PO Box 1927, Spartanburg, SC*———This latest revision of DMRC's publication shows the advantages inherent in Agilon stretch yarn in seamless hosiery and gives detailed instructions for styling, knitting and finishing.

AN EVALUATION OF FUNGICIDAL TREATMENTS IN COTTON CARGO PARACHUTE WEBBINGS STORED AT COLLEGE, ALASKA — PART 2 — *PB 151252, E F Little, Wright Air Development Ctr, US Air Force, Aug 1958, may be ordered from OTS, US Dept of Commerce, Washington 25, DC; 58 pages; $1.50* ——— Air Force research, which showed the fungicidal formulation copper 8-quinolinolate to provide fungus resistance to cotton parachute webbings stored in a subarctic climate, is described in this report just released to industry through the Office of Technical Services, US Department of Commerce.

The webbings were tested after prolonged shelf storage in College, Alaska. The minimum metallic copper content as copper 8-quinolinolate was determined to be 0.14 percent by dry weight of the treated material. Accordingly, the minimum amount of copper 8-quinolinolate required to give adequate fungus resistance was 0.83 percent by dry weight of the treated material.

A formulation of dihydroxy-dichlorodiphenyl methane was found equally acceptable, providing the minimum fungicide content was 0.9 percent by dry weight of the treated material. Water repellents added to the basic fungicidal formulations slightly improved overall fungus resistance.

(Part 1 of the report series was previously released and is still available from OTS. It is PB 131158 *An Evaluation of Fungicidal Treatments in Cotton Cargo Parachute Webbings Stored at Wright Air Development Center,* May 1957, 98 pages, $2.50.)

BULLETIN #10—*Alloy Steel Products Co, Inc, Linden, NJ*———Bulletin #10 features Hastelloy valves in Alloys B, C and D. Casting techniques are described. Uses for the alloys in hydrochloric acid, sulfuric acid, chlorine and other severe corrosive environments are discussed. Included are illustrations of important valve designs and a discussion of chemical composition and mechanical properties.

BULLETIN A-109—*Commercial Development Dept, General Aniline & Film Corp, 435 Hudson St, New York 14, NY* ———This revised and enlarged technical bulletin on 2-butene-1,4-diol describes the physical properties of butenediol and outlines the major types of chemical reactions in which it can take part. These include esterification, reaction with halogens, nitration, ether formation, ring closure by dehydration or by condensation with amines, Diels Alder reactions, epoxidation, copolymerization and isomerization.

The bulletin also includes a brief discussion of the applications of butenediol derivatives in uses such as textile assistants, plastics and resins, solvents, plasticizers, etc.

BUSINESS AND SPECIALIZED PUBLICATIONS OF GREAT BRITAIN—*British Information Services, 45 Rockefeller Plaza, New York 20, NY*———More than 300 British trade and technical publications, most of them weeklies or monthlies, are described in this recently published booklet, which was published by members of the Periodical Proprietors Association Ltd.

Magazines vary from "The Textile Manufacturer" dating back to 1875 and "The Brewers' Journal" which is more than 90 years old to "Technology" founded last year, "Nuclear Engineering" which started in 1956, and "Automation Progress," a monthly which claims to be as up-to-date as tomorrow.

The booklet is brightly published, illustrated with pictures of the front cover of each journal.

CARRIER DYEING—*Emkay Chemical Co, 319 Second St, Elizabeth, NJ*——— This 4-page brochure contains recommendations for using Emkay's Emkalar DA, Emkalar 29 and Emkalar MN in carrier dyeing of Dacron and Arnel.

Practical information covers package dyeing, jig dyeing, box dyeing, together with laboratory test procedures. A chart outlines other auxiliaries used in the scouring and dyeing of these fibers.

COMPARATIVE LIGHT-EXPOSURE TESTS WITH NATURAL DAYLIGHT AND THESE TESTERS: XENOTEST PL393, FUGITOMETER, CPA FADING LAMP, AND FADE-OMETER—*G F Bush Associates, Princeton, NJ*———Translated copies of this article by L C Friele and H J Selling of Vezelinstitut PNO, Delft, Netherlands, which appeared in the November 1957 issue of *Melliand Textilberichte,* are available in quantity from Bush Associates.

The article discusses the advantages and disadvantages of prominent weathering testers.

COMPILATION OF ABSTRACTS OF PATENTS AND JOURNAL REFERENCES ON DIMER ACID—*Emery Industries, Inc, Dept 5, Carew Tower, Cincinnati 2, Ohio*———Technical Bulletin No. 412 (28 pages) contains abstracts of 113 United States Patents and 27 published articles dealing with the use and application of the acid, which is a mixture of relatively high-molecular-weight dibasic and tribasic acids.

Fields of use covered by the patents and articles include polymers, surface coatings, urethane foams, rust inhibitors and viscosity improvers for synthetic fibers, lubricants, waxes and adhesives, among others.

CONSUMER SATISFACTION WITH WOMEN'S BLOUSES. PART II: LABORATORY - WEAR STUDIES — *Bulletin 342, Agricultural Experiment Station Univ of Rhode Island, Kingston, RI*——— This 64-page, illustrated publication (Northeast Regional Bulletin 35) covers Part II of the Northeast Regional Research Project "Consumer Satisfaction with Women's Blouses", which was conducted by home economists at Cornell Univ, Univ of New Hampshire, Pennsylvania State Univ, Univ of Rhode Island, and Univ of West Virginia in cooperation with the Agricultural Experiment Stations in those states.

Part I, "Field Study in Four Communities in the Northeast", is reported in Northeast Regional Bulletin 34.

Part II comprises an extensive coverage of procedures for the laboratory-wear studies, as well as results and discussion under the following headings: Selection of Blouses; Selection of Wearers; Wear and Noncontrolled Care Methods; Wear and Care Records; Interviews with Wearers; Experimental Design for Each State for Wear and Care of Blouses; Laboratory Examination of Blouses for Faults; Physical and Chemical Tests of Blouse Fabrics; Blouse Defects and Faults; Yarn and Fabric Structure, and Removable Sizing and Finishing Materials; Dimensional Stability, Fabric Weight, Yarn Count, and Sizing and Finishing Materials: Breaking Strength, Elongation, and Resistance to Abrasion; Crease Recovery, Reflectance, and Color Change; Resumé of Physical Properties of the New and Laundered Blouse Fabrics; Wearer's Opinions of Blouses; Relationships between Laboratory Data and Wearer's Opinions; and Relationships between the Laboratory-Wear and the Field Studies.

Twenty-six tables and six references to the literature are included.

Mary C Whitlock, professor of textiles and clothing at Univ of Rhode Island, is chairman of the technical committee for the project.

DATA SHEET ND46-20(2)—*Leeds & Northrup Co, 4939 Stenton Ave, Philadelphia 44, Pa*———Measurements of pressure, flow and other variables, detected by three-terminal potentiometer (resistance) type transducers, can now be indicated and recorded by a new adaption of the Leeds & Northrup Speedomax Type H instrument. Utilizing a ratio form of Wheatstone bridge circuit, the Speedomax recorder is designed to operate with transducers having a total resistance between 1000 and 10,000 ohms.

Supplied in either round- or strip-chart models, these new Speedomax Type H instruments can be equipped with any of L&N's automatic control systems.

DOWPAC — APPLICATIONS IN WASTE TREATMENT—*Plastics Merchandising Dept, The Dow Chemical Co, Midland, Mich*———According to Dow, this 32-page bulletin about Dowpac, the company's new plastic packing material used in the biological oxidation of liquid wastes, is of interest to all persons concerned with waste disposal, both industrial and municipal.

The bulletin contains illustrated information on the product's physical properties, assembly instructions and operational characteristics.

Information also is given which explains the wide design latitude possible with Dowpac, and includes performance data gathered from a variety of pilot-plant installations.

DYEING OF CRESLAN — *Allied Chemical Corp, National Aniline Div, 40 Rector St, New York 6, NY*——— Technical Service Circular 18 deals with procedures for applying various classes of dyes to this new acrylic fiber, which is manufactured by American Cyanamid Co.

The 51-page brochure shows the fastness properties of National dyes when applied to Creslan, including results of tests conducted for washing, acid and alkaline perspiration, rubbing and light-fastness.

Creslan is characterized by excellent textile properties and high affinity for dyestuffs. Creslan fiber is used in knitwear such as sweaters, jumpers, dresses, suits, headwear, socks and underwear. It's also suitable for knit blankets and carpets and for industrial applications.

EFFECT OF DRY AND WET CLOTHING ON BODY COOLING AT LOW AIR TEMPERATURES———*F Hall Jr, A P Kearney, J W Polte, and S Quillette, Wright Air Development Center, US Air Force, May 1958. 26 pages. (Order PB 151206 from OTS, US Department of Commerce, Washington 25, DC, $1.00)* ———A series of predictive curves for human tolerance for subjects clothed in wet and dry garments while exposed to low air temperatures in a life raft was compiled. The curves enable estimation of potential rescue times for personnel exposed to icy seas. Data showed that exposure of subjects unprotected by water-impermeable, anti-exposure suits to extremely cold (1.7°C) water is possible provided the water-exposure time is for two minutes or less; the subject quickly enters his life raft where rate of body cooling is greatly reduced and the chilled skin is rewarmed; and reimmersion in cold water does not occur. Variation of water-immersion time from 15 to 120 seconds did not significantly increase the percentage of water absorbed by the clothing.

HIGH-TEMPERATURE 8-BEAKER SAMPLE DYEING UNIT—*The Longclose Engineering Co Ltd, Crescent Works, Dewsbury Rd, Leeds 11, England* ———This illustrated leaflet covers this new unit for testing dyestuffs, assistants, and formulating recipes, etc, at similar temperatures and liquor ratios as encountered in the commercial size machines.

LINDLY R & D SERVICES—*Lindly & Co., Mineola, NY*———This brochure describes the company's facilities and experience available for research and development in the photoelectric, infrared optical electromechanical and electronic fields.

LIQUID POLYMER/EPOXY RESIN SYSTEMS—*Thiokol Chemical Corp, 780 North Clinton Ave, Trenton 7, NJ*——— This bulletin describes the proper methods for selecting and compounding liquid polymers with suitable epoxy resins, curing agents and fillers to obtain the desired handling and physical properties from the wide range possible. Charts and tables are included showing the effect of compounding variables on tensile strength, impact resistance, water absorption and other important physical properties which are available with this system.

LTI GRADUATE THESES—*Office of Special Services, Lowell Technological Inst, Lowell, Mass*———A quarterly technical bulletin issued Dec 31 by Lowell Technological Institute contains the comprehensive listing of all graduate theses completed at the Institute in the 12-year period 1946 to 1958.

METROTONE-METROTEX COLOR CARD—*Metro-Atlantic, Inc, Centredale 11, RI*———This color card covers Metro-Atlantic's complete line of Metrotone oil-phase printing pigments, and Metrotex water-phase emulsion printing pigments. The book shows all Metro-Atlantic's pigment colors in three strengths with data as to drycleaning, washing, plissé properties, discharge properties, light-fastness, and specific gravity. It also gives data concerning Metrotone-Metrotex clears and "low crock" compounds. It also includes the metallic prints that can be made with these clears. The book is practical for color shop use, laboratory use, and for use in purchasing departments.

MUNICIPAL SEWAGE TREATMENT NEEDS—*15¢; Supt of Documents, U S Gov't Printing Office, Washington 25, DC* ———Public Health Service Publication No. 619 is a companion document to PHS Publication No. 609 entitled "Statistical Summary of Sewage Works in the United States", which is a summarization of physical facilities data based on the 1957 Inventory of Sewage and Industrial Waste Facilities. The Inventory also contained information on reported needs both for present treatment plants and for systems discharging raw sewage. This report presents summarized information on these sewage disposal requirements.

NALCOAG COLLOIDAL SILICA—*National Aluminate Corp, 6216 West 66th Pl, Chicago 38, Ill*———Nalcoag can be used in frictionizing textile fibers, according to the manufacturer. The result is said to be greater strength, better fiber parallelization and more uniformity of fiber dispersion in blends.

The product is offered as a suspension of 15, 30, or 35% silica in an aqueous medium or 22% silica in an aqueous-alcohol medium.

Bulletin K5 describes the physical and chemical properties of Nalcoag, and lists present and potential uses.

ORGANIC SILICON COMPOUNDS (KREMNIYORGANICHESKIYE SOEDINENIYA)—*59-11239; K A Andrianov, State Scientific Technical Publishing House for Chemical Literature, Moscow, 1955; translated by the Technical Documents Liaison Office, US Air Force. Order from OTS, US Dept of Commerce, Washington 25, DC, for $10 a copy*——— A comprehensive study of the chemistry and uses of organosilicon compounds by a leading Russian authority. The monograph was prepared by chemist K A Andrianov from information drawn from the literature to mid-1954 and from his own experience in the practical development of the versatile, relatively new material. It was intended for use by Soviet scientists, engineers, technologists, and students.

Covered in the 920-page book are methods of preparation and the physical and chemical properties of large numbers of both monomeric and high-polymer organosilicon compounds. Uses of the compounds in such fields as textiles, electrical materials, metals coatings, lubricants and hydraulic fluids, plastics, and precision castings are discussed.

PARTICULARS OF THE DECHEMA-WERKSTOFF-TABELLE — *DECHEMA, Frankfurt (Main) 7, Germany*———This free 20-page pamphlet gives full particulars of the Dechema-Werkstoff-Tabelle, a standard work of reference which will ultimately consist of a total of 1200 pages.

Corrosive Properties—Formaldehyd to Kaliumnitrit are described in the 8th Installment, which represents a contribution of 100 pages of precise data on the chemical resistance of about 100 constructional materials to 46 corrosive substances. Six pages are devoted in each case to detailed information on glycerine and glycol and there are eight pages on potassium cloride. Pages dealing with urea, potassium and potassium-sodium alloys, potassium bichromate and potassium nitrate are of particular interest. The properties of potassium hydroxide will be described in the 9th installment.

The price of the Dechema-Werkstoff-Tabelle is DM 40 per installment (DM 32 to members of Dechema). Single pages cannot be supplied and only the complete work in consecutive page numbers is obtainable from DECHEMA.

RESEARCH PROGRAM FOR THE DEVELOPMENT OF A DESIGN PROCEDURE TO ENGINEER PARACHUTE FABRICS—*W G Klein, C A Lermond, and M M Platt, Fabric Research Laboratories, Inc, for Wright Air Development Center, U S Air Force. May 1958. 56 pages. (Order PB 151209 from OTS, U S Department of Commerce, Washington 25, D C, $1.75.)*———This report gives an analysis defining the mechanisms of air flow through parachute materials. Since the fabric is treated as a three- rather than a two-dimensional structure, it is believed that it gives a more accurate description of air flow than the previous analyses. Fabrics considered are those conforming to the physical specifications of MIL-C-7020, Types I and II, but with permeabilities ranging from well below to well above current specifications. Very satisfactory results were obtained in explaining permeability on the basis of fabric structure. It was observed, however, that some of the variables controlling permeability must be held closer for specified permeability ranges than is possible by commercial practice.

SERIES 5000 NARDA SONBLASTER ULTRASONIC CLEANER—*The Narda Ultrasonics Corp, 625 Main St, Westbury, LI, NY*———The giant size Series 5000 Narda SonBlaster ultrasonic cleaner reportedly is the largest capacity mass-produced ultrasonic cleaning equipment available. The series consists of 23 systems for applications to mass-production cleaning or degreasing of mechanical, electronic, and optical assemblies; to rapid cleaning of radioactive elements, "hot" lab apparatus, ceramic materials, electrical components and technical glassware; to expediting wet finishing and chemical processing of many kinds; and to laboratory mixing.

The data sheet describes Model G-5001, a 40-kc, 500-watt average output SonBlaster generator designed for energizing a wide range of cleaning tanks, and the G-5002, a 20-kc 500-watt average output generator which will operate magnetostrictive transducers for high-intensity or high-temperature applications.

Generators feature tank selector and load selector switches to operate one or two 500-watt 10-gallon transducerized cleaning tanks Model NT-5001 or magnetostrictive transducers alternately, and various combinations of smaller tanks and submersible transducers simultaneously or alternately. The G-5001 generator reportedly will operate from 6 to 10 high-energy submersible transducers at any one time in tanks of any shape up to 70-gallon volume. This equipment is available starting from $1140. Most items of the series can be shipped from stock.

In addition to complete data on the 23 systems of the Series 5000, detailed information is given on applications and processes for which this equipment can be used. Tanks of different sizes and submersible transducer arrangements are illustrated.

SPECIFICATIONS AND CHARACTERISTICS OF ORGANIC CHEMICALS—*Emery Industries, Inc, Dept 5, Carew Tower, Cincinnati 2, Ohio*———This new edition of Emery Industries' catalog lists product designations, descriptions, and specifications for Emery's line of organic chemicals. Included for the first time are the Metholene fatty acid esters, as well as other individual products that have been added during the past year. Other organic chemicals that are covered in the brochure are Empol dimer acid; Emerox azelaic acid; Emfac pelargonic, capric, and caprylic acids; Emolein esters for synthetic lugricants; Plastolein plasticizers; Twitchell fat-splitting reagent; and Twitchell and Emersoft textile chemicals.

STEELAB PRE-ENGINEERED INTERRCHANGEABLE SECTIONAL UNITS—*Laboratory Furniture Co, Inc, Old Country Rd, Mineola, NY*———Catalog No. W-4 (24 pages, 2 colors) shows how, with a comprehensive line of interchangeable "package" units, a completely equipped laboratory can be set up virtually within 24 hours. The catalog illustrates and describes drawers, cupboards, sinks, tables, desks, chairs, storage cabnets, fume hoods, auxiliary units, and a full line of accessories and service fixtures. Featuring Labflex patented construction, which is said to permit a wide range of flexibility in furniture design and room layout, Steelab standard sectionals reportedly can be used to fully equip a laboratory, matched to supplement an existing laboratory, or set up as a basic science and research center for future expansion. The manufacturer also provides a unique planning kit of scaled cut-out templates and scaled planning paper to develop a do-it-yourself floor plan to fit laboratory requirements.

SUPPLEMENTARY BULLETIN—ASTON 108 ON NAPPED SYNTHETIC FABRICS—*Onyx Oil & Chemical Co, Jersey City 2 NJ*———Bulletin outlines the advantages of finishing napped synthetic fabrics with Aston 108 and explains in detail the manufacturer's recommendations for proper application of this antistatic agent to this type of fabric.

Noting that synthetics have made rapid strides in the napped fabric field as a competitor to cotton, the bulletin states "one serious criticism of the use of napped synthetics, as of all hydrophobic fibers, is their propensity to build-up a high charge of static electricity. It is now possible to prevent this build-up to allow the static charge to leak off the fabric as rapidly as it is formed, and to maintain this property after a long series of washings."

SYNTHETIC ORGANIC CHEMICALS, UNITED STATES PRODUCTION AND SALES, 1957—*Report No. 203, Second Series; 60¢; Supt of Documents, U S Govt Printing Office, Washington 25, DC*———The United States Tariff Commission has released its forty-first annual report on production and sales of synthetic organic chemicals in the United States. In 1957, according to the report, production of synthetic organic chemicals and their raw materials was 84.847 million pounds—an increase of 3.3 percent over the 82.121 million pounds produced in 1956. Sales of synthetic organic chemicals and their raw materials in 1957 amounted to 45.375 million pounds, valued at 6,077 million dollars compared with 45,518 million pounds valued at 5,831 million dollars, in 1956. As these totals include data for chemical raw materials, as well as semifinished and finished products, they necessarily involve considerable duplication. Earlier this year the Commission issued preliminary reports on production and sales in 1957 of the 14 individual groups of synthetic organic chemicals covered in the final report.

Statistics included in the final report were compiled from data supplied by 664 manufacturing companies and company divisions. The report covers about 6,000 individual chemicals and chemical products, and gives separate production and sales statistics for many of them. Also included in the report is a list of manufacturers of each item for which production and sales were reported, and statistics on United States general imports in 1957 of products entered under paragraphs 27 and 28 of the Tariff Act of 1930, which cover coal-tar intermediates, dyes, medicinals, and other finished coal-tar products. The report also presents statistics on the number of technical workers engaged in research in the synthetic organic chemical industry, their average salaries, and the amounts expended for such research by the reporting companies.

The report comprises three major sections—those on chemical raw materials, cyclic intermediates, and finished synthetic organic chemical products. The first section includes statistics on tar, tar crudes, and crude chemicals derived from petroleum and natural gas. Total production of coal tar, water-gas tar, and oil-gas tar in 1957 amounted to 916 million gallons—3.8 percent more than the 881 million gallons reported for 1956. Production in 1957 of all tar crudes amounted to 14.361 million pounds, compared with 14.560 million pounds in 1956. The most important individual products in this group are benzene, toluene, napthalene, and creosote oil. The output of crude products from petroleum and natural gas in 1957 was 18.094 million pounds, compared with 17.898 million pounds in 1956. Included in this group are benzene, toluene, xylene, and other cyclic products, and aliphatic hydrocarbons, such as ethylene, propane, and 1.3-butadiene, the latter being one of the basic raw materials for the manufacture of S-type synthetic rubbers.

Production of cyclic intermediates, which is covered in the second section of the report, amounted to 6.927 million pounds in 1957—an increase of 5 percent over the 6.600 million pounds produced in 1956. As in earlier years, more than 60 percent of the output of cyclic intermediates was used by the original manufacturers to produce more advanced products. The remainder was sold to other companies for further processing.

The third section of the report deals with finished synthetic organic chemicals and chemical products. The total output of such products amounted to 36 309 million pounds in 1957, compared with 34,153 million pounds, in 1956. Of this

total, cyclic finished products accounted for 6,634 million pounds, and acyclic products for 29,674 million pounds. Of the 11 groups of finished synthetic organic chemicals, eight were produced in greater quantities in 1957 than in 1956, and three were produced in smaller quantities. The groups for which production increas d were rubber-processing chemicals (11.2 percent), medicinals (10.5 percent), plastics and resin materials (9.1 percent), miscellaneous chemicals (6.8 percent), plasticizers (6.1 percent), surface-active agents (5.0 percent), elastomers (1.7 percent), and flavor and perfume materials (1.4 percent). Groups for which production declined were pesticides and other organic agricultural chemicals (10.2 percent), toners and lakes (7.9 percent), and dyes (5.6 percent).

TAYLOR SENSAIRE 202T TEMPERATURE TRANSMITTER—*Taylor Instrument Companies, Rochester 1, NY*———Four-page illustrated bulletin 98-293 gives complete information on this unit, which is discussed on page 66 of the March 9 issue of ADR.

TECHNICAL SOCIETIES GUIDE—*$3.00; Industrial Publicity Association, Societies Committee, Rm 1616, 41 E 42nd St, New York 17, NY*———This new reference manual of procedures required by technical societies and trade associations for presentation and preparation of papers has been prepared to serve as a reference for both industrial publicist and engineer by giving specific procedures for formal presentations of technical papers and the preparation of associated publicity.

Prepared in cooperation with 36 leading technical societies, the guide contains data on: membership structure, number of members, principal meeting dates, subjects of interest, paper requirements, mechanics of contribution, policies on preprints and reprints, restrictions and rights to papers and data on each society's publication and publicity policy.

Included in a special section for authors are suggestions regarding the content of papers, fundamentals of oral presentation and preparation of visual aids as well as information on the preparation of the manuscript for submission to the editors of society publications.

TEXTILE AUXILIARIES CATALOGUE—*Metro-Atlantic, Inc, Centredale 11, RI*———Consists of 200 pages and describes in full detail, 90 of Metro-Atlantic's most important textile auxiliary products. This catalogue contains a descriptive index and all of the bulletins are entered into the book by use category, making it a convenient and quick reference.

TEXTILE DYEING METHODS—*Allied Chemical Corp, National Aniline Div, 40 Rector St, New York 6, NY*——— Current dyeing theories and techniques used in successful dyeing of textiles are explained simply in this handy booklet, which is intended for use by secondary schools, textile colleges and technical institutions and for those engaged in wet processing of textiles.

The information is divided into four parts: a general description of textile fibers; classification of dyestuffs; explanation of the dyeing process; and, the dyeing of various fibers with specific classes of dyestuffs.

TEXTONE—*Olin Mathieson Chemical Corp, Chemicals Div, Baltimore 3, Md*———This 26-page descriptive booklet on Textone sodium chlorite includes sections dealing with the use of the chemical in acid bleaching, alkaline bleaching, oxidation of vat dyes, and the stripping of dyestuffs.

THE USE OF SODIUM BISULFITE—*Inorganic Chemicals Div, Monsanto Chemical Co, 800 North Lindbergh Blvd, St Louis 66, Mo*———In addition to covering the physical properties, typical analyses and general description of the product, the bulletin covers specific uses of the chemical in the textile, dye synthesis, leather, photographic, electroplating, medical, food processing and other industries.

THE USE OF THE TOTE SYSTEM OF BULK MATERIALS HANDLING—*Tote System Inc, Beatrice, Neb*——— Catalog #7 describes the Tote System in detail, exhibiting and explaining Tote Bins, Tote Tanks, Tote Tilts, and accessory equipment, used in conjunction with automatic filling and discharge stations, in inter- and intra-plant operations, in conjunction with both batch and continuous process activities. It cites examples of how the system saves labor, container and shipping costs while reducing warehouse space requirements and describes the various methods of transporting the unit containers. It also photographically illustrates its adaptability to flatbed cars and bulk hopper cars.

A list of users and materials presently handled is included in the booklet.

TRUSCALE REMOTE READING LIQUID LEVEL GAUGES—*Jerguson Gage and Valve Co, Burlington, Mass*———New eight-page, three-color Catalog #338 covers in detail the complete line of Jerguson Truscale gages including standard, red flasher and inclined styles. These gages are for remote liquid level indication for boilers, deaerating vessels, boiler feed water tanks, storage tanks, etc. Information on the various styles, models and datum columns is presented to aid selection of the Truscale best suited for specific requirements. Features operation and application data, and accessories are explained in detail.

101 WAYS TO SERVE YOU—*Apex Chemical Co, Inc, 200 South First St, Elizabethport 1, NJ*———This 12-page booklet lists the complete range of products offered by Apex, arranged in alphabetical order. It also lists the technical service which the firm is equipped to perform.

ZEFRAN—DYEING AND FINISHING—*The Dow Chemical Co, James River Div, Williamsburg, Va*———This is the fifth installment of the technical bulletin Dow Chemical Co is preparing on its Zefran acrylic alloy fiber. Other installments cover processing, weaving, properties, and general information.

Technical data is presented on the preparation, dyeing, and printing of Zefran alone and in blends with cellulosic fibers and with wool, along with information on the mechanical and chemical finishing of fabrics containing Zefran.

More than 40 pages are devoted to listings of recommended dyestuffs for Zefran, including the Colour Index designations, commercial names, and fastness data for vats, naphthols, sulfurs, aftertreated directs, and neutral premetalized acids.

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